HECTOR — HANDBOOK OF NEW ZEALAND

MELBOURNE INTERNATIONAL EXHIBITION,
1880.

HANDBOOK

OF

NEW ZEALAND

By

JAMES HECTOR, M.D., C.M.G., F.R.S.,

DIRECTOR OF THE GEOLOGICAL SURVEY.

WITH MAPS AND PLATES.

[SECOND EDITION REVISED.]

Wellington:
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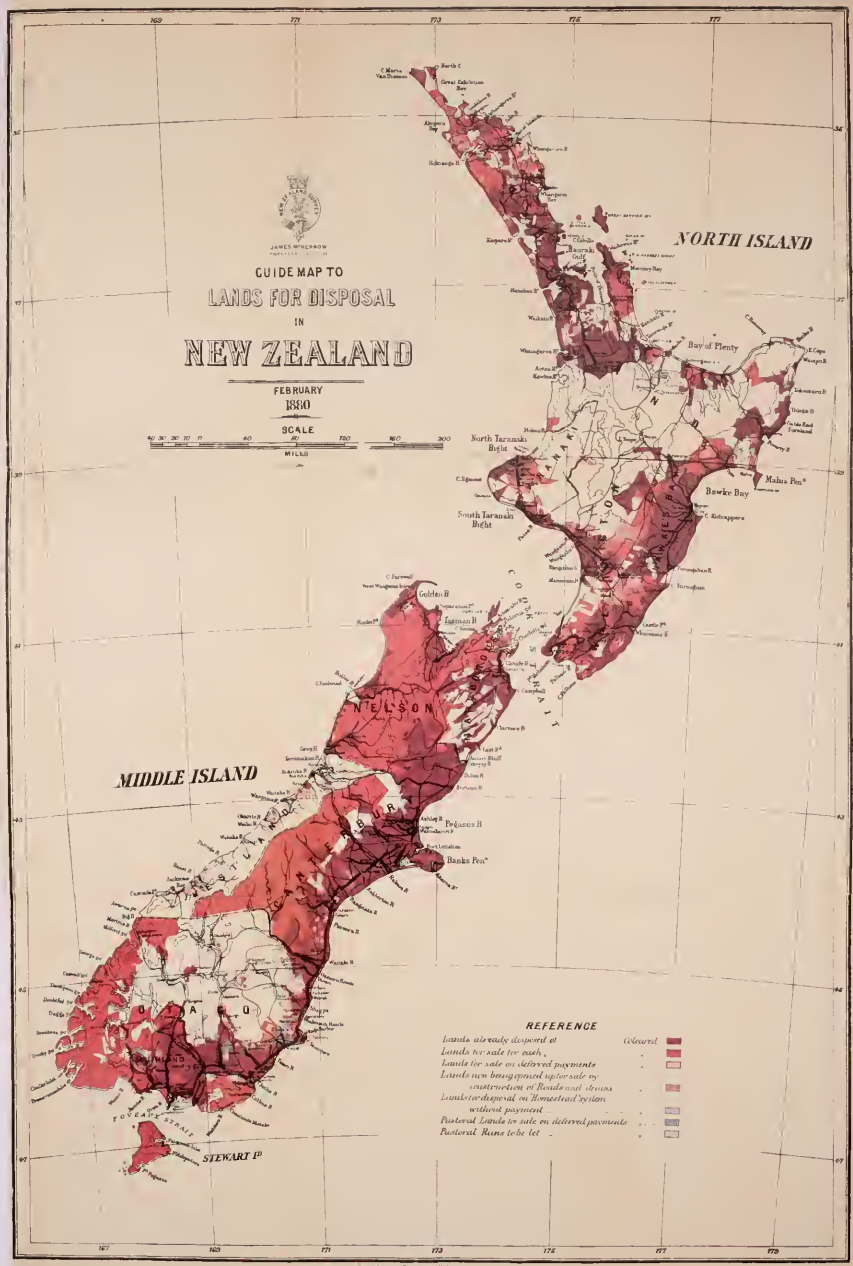
JAMES McKERROW
GUIDE MAP TO
LANDS FOR DISPOSAL
IN
NEW ZEALAND
FEBRUARY
1880
SCALE
MILES
NORTH ISLAND
MIDDLE ISLAND
Bay of Plenty
North Taranaki Bight
South Taranaki Bight
Hawke Bay
Golden B
Tasman B
Pegasus B
Banks Pen.
Otago
Southland
STEWART I.D
REFERENCE
Lands already disposed of
Lands for sale for cash
Lands for sale on deferred payments
Lands now being opened upfor sale on construction of Roads and Bridges
Lands for disposal on Homestead System without payment
Pastoral Lands for sale on deferred payments
Pastoral Runs to be let

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PREFACE.

This Handbook was first published in accordance with a resolution of the Royal Commissioners appointed by His Excellency the Governor of the Colony to carry out and devise the proper representation of New Zealand at the Sydney Exhibition, and the present revised edition has been prepared by direction of the Hon. the Premier.

In its preparation several previous works of a similar nature have been largely drawn from, among which may be mentioned in particular the Jurors' Reports and Awards of the New Zealand Exhibition, 1865, (Dunedin, 1866); the admirable and exhaustive "Handbook of New Zealand" published by Sir Julius Vogel, K.C.M.G., (London 1875); and the Official Reports on the New Zealand Court in the Philadelphia Exhibition, 1876, by the writer, (London, 1877).

The records of the various Government Departments have been also largely made use of; and particularly I have to acknowledge the valuable aid afforded me by Mr. W. R. E. Brown, Registrar-General for the Colony, in the Statistical portion of the work.

In carrying out the details of this publication, I have been ably assisted by Mr. S. Herbert Cox, F.G.S., and by Mr. Bryce Bain; and to the latter gentleman I am especially indebted for the compilation of the Statistical Diagrams comparing the progress of New Zealand with the other Colonies of the Australasian Group.

JAMES HECTOR,
EXECUTIVE COMMISSIONER.

Colonial Museum,
Wellington, 1st February, 1880.

ERRATA.

PAGE

7—For "Pokako," read "Pokaka." For "*Podocarpus dacrydoides*," read "*Podocarpus dacrydioides*." For "*Libocedrus doniriana*," read "*Libocedrus doniana*." For "*Olea apetala*," read "*Olea cunninghamii*." For "Maire *(Eugenia maire)*," read "Maire taiwhaki (*Eugenia maire*)." For "*Letospermum ericoides*," read "*Leptospermum ericoides*." For "matapo, or tarrata, black mapau *(Pettospermum tennifolium)*," read "Matipo tarata *(Pittosporum tenuifolium)*." For "*Metrosoideros lucida*," read "*Metrosideros lucida*." For "*Nesodaphne taraire*," read "*Nesodaphne tarairi*." For "*Towai*," read "*Tawai*." For "*Entetia aborescens*," read "*Entelea aborescens*."

8—For "*Weinmannia racemosa*," read "*Fagus manziesii*." For "atawhero *(Rhabdothamnus solandri)*," read "tawhero *(Weinmannia racemosa)*." For "Coraria ruscifolia," read "Coriaria ruscifolia."

33—For "dessicate," read "desiccate." For "irridescent," read "iridescent."

45—For "Mauntahi, Waiapu, East Cape," read "Manutahi, Waiapu, East Cape." For "occurring in Stanta Barbara County," read "occurring in Santa Barbara County."

45, 46, 58, 59, 108—For "Faht.," read "Fahr."

48—For "Diorites," read "Diorite."

52—For "pozzuolano," read "puzzolana."

68—For "Persons engaged in the domestic offices or duties of wives, mothers, mistresses of families," read "Persons engaged in domestic offices or duties."

70—For "Ngatiporn," read "Ngatiporu."

71—For "The Rarawa," read "The Arawa."

94—For "Griselina littoralis," read "Griselinia littoralis." For "*Podocarpus dacrydoides*," read "*Podocarpus dacrydioides*. For "Pyrimidal," read "pyramidal."

95—For "monoao," read "manoao." For "*Phyllocladus Alpinus*," read "*Phyllocladus alpinus*." For "Tawhai-rau-nui," read "Tawhairaunui."

96—For "Order, myrtacæ," read "Order, myrtaceæ." For "*Leptospermum erecoides*," read "*Leptospermum ericoides*."

109—For "diarhœa," read "diarrhœa."

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APPENDIX.

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HANDBOOK

OF

NEW ZEALAND.

GENERAL DESCRIPTION.

SITUATION AND AREA.

North and South Islands.

The Colony of New Zealand consists of two Islands called the North and South Islands, and a small island at the southern extremity called Stewart Island. There are also several small islets such as the Chatham and Auckland Isles that are dependents of the colony. The entire group lies between 34° and 48° S. lat. and 166° and 179° E. long. The two principal islands, with Stewart Island, extend in length 1,100 miles, but their breadth is extremely variable, ranging from 46 miles to 250 miles, the average being about 140 miles, but no part is anywhere more distant than 75 miles from the coast.

Total Area.—Separate Areas.

	Sq. miles	Acres.
The total area of New Zealand is about -	100,000	or 64,000,000
,, ,, the North Island being -	44,000	,, 28,000,000
,, ,, the South Island being -	55,000	,, 36,000,000
,, ,, Stewart's Island being -	1,000	,, 640,000

It will thus be seen that the total area of New Zealand is somewhat less than Great Britain and Ireland. The North and South Islands are separated by a strait only thirteen miles across at the narrowest part, presenting a feature of the greatest importance to the colony from its facilitating inter-communication between the different coasts without the necessity of sailing right round the colony.

The North Island was, up to the year 1876, divided into four provinces, viz., Auckland, Taranaki, Hawke's Bay, and Wellington; Taranaki and Hawke's Bay lie on the west and east coasts respectively, between the two more important provinces of Auckland on the north, and Wellington on the south.

The South Island was divided into five provinces, viz., Nelson, Marlborough, Canterbury, Otago, and Westland (Southland was for a short time an independent province); Nelson and Marlborough are in the north, Canterbury in the centre, Otago in the south, and Westland to the west of Canterbury.

These provinces, however, in 1877 were abolished and divided into 63 Counties—32 in the North Island, and 31 in the South Island—and Provincial Government ceased to exist.

Names of Counties.

The following are the names of these Counties :—

In the North Island.—Mongonui, Hokianga, Bay of Islands, Whangarei, Hobson, Rodney, Waitemata, Eden, Manukau, Coromandel, Thames, Piako, Waikato, Waipa, Raglan, Kawhia, Taranaki, Patea, Tauranga, Whakatane, Cook, Wairoa, Hawke's Bay, Wanganui, West Taupo, East Taupo, Rangitikei, Manawatu, Waipawa, Hutt, Wairarapa West, Wairarapa East, counties.

In the South Island.—Sounds, Marlborough, Kaikoura, Waimea, Collingwood, Buller, Inangahua, Amuri, Cheviot, Grey, Ashley, Selwyn, Akaroa, Ashburton, Geraldine, Waimate, Westland, Waitaki, Waikouaiti, Maniatoto, Vincent, Lake, Peninsula, Taieri, Bruce, Clutha, Tuapeka, Southland, Wallace, Fiord, and Stewart Island counties.

Mountains and Plains.

New Zealand is very mountainous, with extensive plains, lying principally on the eastern side of the mountain range in the South Island, while in the North Island they lie on the western side, the interior, or more mountainous parts, being covered with dense forest, while those of the South Island are open for the greater part, and well grassed, and used for pastoral purposes.

In the North Island the mountains occupy one-tenth of the surface, and do not exceed from 1,500 to 6,000 feet in height, with the exception of a few volcanic mountains that are very lofty, one of which, Tongariro (6,500 feet) is still occasionally active. Ruapehu (9,100 feet) and Mount Egmont (8,300 feet) are extinct volcanoes that reach above the limit of perpetual snow, and the latter is surrounded by one of the most extensive and fertile districts in New Zealand.

The range in the South Island, known as the Southern Alps, is crossed at intervals by low passes ; the greatest height of the main range is from 10,000 feet to 14,000 feet, and it has extensive snow fields and glaciers.

HISTORY.

First Settlement by Maoris.

New Zealand appears to have been first discovered and first peopled by the Maori race, a remnant of which still inhabits parts of the islands. At what time the discovery was made, or from what place the discoverers came, are matters which are lost in the obscurity which envelopes the history of a people without letters. Little more can now be gathered from their traditions than that they were immigrants ; and that when they came there were probably no other inhabitants of the country. Similarity of language indicates a northern origin, probably Malay, and proves that they advanced to New Zealand through various groups of the Pacific islands in which they left remains of the same race, who to this day speak the same or nearly the same tongue. When Cook first visited New Zealand he availed himself of the assistance of a native from Tahiti, whose language proved to be almost identical with that of the New Zealanders, and through the medium of whose interpretation a large amount of information respecting the country and its inhabitants was obtained which could not have been had without it.

Discovery by Tasman.

The first European who made the existence of New Zealand known to the civilized world, and who gave it the name it bears, was Tasman, the Dutch navigator, who visited it in 1642. Claims to earlier discovery by other European explorers have been raised, but they are unsupported by any sufficient evidence. Tasman did not land on any part of the islands, but having had a boat's crew cut off by the natives in the bay now known as Massacre Bay, he contented himself by sailing along the western coast of the North Island, and quitted its shores without taking possession of the country in the name of the Government he served; a formality which, according to the law of nations (which regards the occupation by savages as a thing of small account), would have entitled the Dutch to call New Zealand theirs—at least so far as to exclude other civilized nations from colonizing it, and conferring on themselves the right to do so. From the date of Tasman's flying visit to 1769, no stranger is known to have visited the islands. In the latter year Captain Cook reached them in the course of the first of those voyages of great enterprise which have made his name illustrious.

Visited by Captain Cook.

The first of Cook's voyages of discovery began in August, 1768, when he was sent to Tahiti to observe the transit of Venus; after a run of 86 days from Tahiti, having touched at some other places, he sighted the coast of New Zealand on 6th October, 1769. On the 8th he landed in Poverty Bay, on the east coast of the North Island.

THE NATIVE RACE.

Origin and Traditional History.

There is nothing on record respecting the origin of the Maori people, but their arrival in New Zealand, according to tradition, is due to an event which, from its physical possibility, and from the concurrent testimony of the various tribes, is probably true in its main facts.

The tradition runs, that generations ago a large migration took place from an island in the Pacific Ocean, to which the Maoris give the name of Hawaiiki, quarrels among the natives having driven from it a chief, whose canoe arrived upon the shore of the North Island of New Zealand. Returning to his home with a flattering description of the country he had discovered, this chief, it is said, set on foot a scheme of emigration, and a fleet of large double canoes started for the new land. The names of most of the canoes are still remembered, and each tribe agrees in its account of the doings of the principal "canoes," that is, of the people who came in them after their arrival in New Zealand, and from which the descent of the numerous tribes is specified. Calculations, based on the genealogical sticks kept by the tohungas, or priests, have been made, that about twenty generations have passed since this migration, which would indicate the date to be about the beginning of the 15th century. The position of Hawaiiki is not known, but there are several islands of a somewhat similar name.

Native Population.—North Island.

The Northern Island now contains a native population of about 40,000, divided into many tribes, and scattered over 45,156 square miles.

The most important tribe is that of the Ngapuhi, which inhabit the northern portion of the North Island, in the province of Auckland. It was among the Ngapuhi that the seeds of Christianity and of civilization were

first sown, and among them are found the best evidences of the progress which the Maori can make. Forty years ago the only town in New Zealand, Kororareka, Bay of Islands, existed within their territories. Their chiefs, assembled in February, 1840, near the "Waitangi," or "Weeping Water" Falls, were the first to sign the treaty by which the Maoris acknowledged themselves to be subjects of her Majesty; and although under the leadership of an ambitious chief, Hone Heke, a portion of them in 1845 disputed the English supremacy, yet when subdued by English troops and native allies (their own kinsmen) they adhered implicitly to the pledges they gave, and since then not a shadow of doubt has been cast on the fidelity of the "Loyal Ngapuhi."

Native Population.—South Island.

The South Island natives number but about 2,000, and they are spread over an immense tract of country, living in groups of a few families on the reserves made for them when the lands were purchased; for the whole of the South Island has been bought from the native owners by the Government. Whatever may be the cause, it is a fact that the natives of the South Island are less restless and excitable than their brethren in the North.

As a rule the Maoris are middle sized and well formed, the average height of the men being 5 ft. 6 in.; the bodies and arms being longer than those of the average Englishman, but the leg-bones being shorter, and the calves largely developed. In bodily powers the Englishman has the advantage. As a carrier of heavy burdens the native is the superior, but in exercises of strength and endurance the average Englishman surpasses the average Maori.

GOVERNMENT.

The colony, up to 1876, was divided into nine provinces, each of which had an elective Superintendent, and a Provincial Council, also elective. In each case the election was for four years, but a dissolution of the Provincial Council by the Governor could take place at any time, necessitating a fresh election, both of the Council and of the Superintendent. The Superintendent was chosen by the electors of the whole province; the members of the Provincial Council by those of electoral districts.

The Provincial form of government was abolished in 1876, and the country divided into counties and road boards, to which, and to the municipalities, local administration, formerly executed by the Provincial Government, is confided. The Seat of Government was at Auckland up to the year 1865, when it was transferred to Wellington, on account of its more central position.

Form of Government.

Executive power is vested in a Governor appointed by the Queen, but he acts in accordance with the principles of responsible Government, which for practical purposes vests the direction of affairs in the representatives of the people. In cases of direct Imperial interest the Governor would, no doubt, act in accordance with instructions from the Imperial Government. Legislative power is vested in the Governor and two chambers, one called the Legislative Council, consisting at present of forty-nine members nominated by the Governor for life, and the other the House of Representatives, elected by the people from time to time, and now consisting of eighty-eight members. Until quite recently, the Lower Chamber was elected for the term of five years, but the Triennial Parliaments Act, passed 19th December, 1879, enacts that the present House of Representatives shall continue

only to the 28th February, 1882, and that the continuance of every future House of Representatives shall be limited to a period of three years.

Except in matters of purely Imperial concern, the Governor, as a rule, acts on the advice of his ministers. He has power to dismiss them and appoint others, but the ultimate control rests with the representatives of the people, who hold the strings of the public purse.

Electoral and Administrative.

Any man of twenty-one years and upwards, who is a born or naturalized British subject, and who has held for six months a freehold of the clear value of £25, or who has resided for one year in the colony, and in an electoral district during the six months immediately preceding the registration of his vote, is now, according to an Act passed December, 1879, entitled to be registered as an elector and to vote for the election of a member of the House of Representatives. Also, every male Maori of the same age whose name is enrolled upon a ratepayers' roll, or who has a freehold estate of the clear value of £25. And by another Act passed on the same day, the duty is imposed upon the Registrar of each electoral district, of placing on the electoral roll the names of all persons who are qualified to vote. Any person qualified to vote for the election of a member of the House of Representatives is also, generally speaking, qualified to be himself elected a member of that House.

There are, however, certain special disqualifications for membership, such as grave crime, bankruptcy, and paid office (other than what is called political) in the colonial service. Four of the members of the House are Natives, elected under a special law by Natives alone.

The Colonial Legislature, which meets once a year, has power generally to make laws for the peace, order, and good government of New Zealand. The Acts passed by it are subject to be disallowed by the Queen, and in a very few cases are required to be reserved for the signification of the pleasure of Her Majesty, but there have not been, in the course of the twenty years since the constitution was granted, more than half a dozen instances of disallowance or refusal of assent. The Legislature has also, with a few exceptions, ample power to modify the constitution of the colony. Executive power is administered, as before stated, in accordance with the usage of responsible government as it exists in the United Kingdom.

Legislation concerning the sale and disposal of Crown lands, and the occupation of the gold fields, is exclusively vested in the Colonial Parliament.

There are in most towns in the colony municipal bodies, such as mayors and town councils in England, invested with ample powers for sanitary and other municipal purposes; and there are in various country districts elective road boards charged with the construction and repair of roads and bridges, and with other local matters. There are also central and local boards of health appointed under a Public Health Act, and having authority to act vigorously, both in town and in the country, for the prevention and suppression of dangerous infectious diseases.

The above short summary of the system of government in New Zealand suffices to show that the leading characteristics of the British Constitution—self-government and localized self-administration—are preserved and, in fact, extended in the New Zealand Constitution; that there is ample power to regulate its institutions, and to adapt them from time to time to the growth and progress of the colony, and to its varied requirements; and that it is the privilege of every colonist to take a personal part to some extent, either as elector or elected, in the conduct of public affairs, and in the promotion of the welfare of the community.

VEGETABLE AND ANIMAL PRODUCTS.

VEGETATION.

The indigenous forest of New Zealand is evergreen, and contains a large variety of valuable woods. Amongst the smaller plants the *phormium tenax*, or New Zealand flax, is of especial value, whilst large tracts of country are covered with indigenous grasses of high feeding quality, which support millions of sheep, and have thus been productive of great wealth to the colony. Many of the more valuable trees of Europe, America, and Australia have been introduced, and have flourished with a vigour scarcely ever attained in their natural habitats. In many parts of the colony the hop grows with unexampled luxuriance; whilst all the European grasses and other useful plants produce returns equal to those of the most favoured localities at home. Fruit, too, is abundant all over New Zealand. Even in the latitude of Wellington, oranges, lemons, citrons, and loquats are found, whilst peaches, pears, grapes, apricots, figs, melons, and, indeed, all the ordinary fruits of temperate climates abound. Roots and vegetables of all kinds grow abundantly.

TIMBER AND FOREST TREES.

The general character of the New Zealand woods resembles the growths of Tasmania and the Continent of Australia, most of them being harder, heavier, and more difficult to work than the majority of European and North American timbers. They vary, however, very much among themselves. Many varieties are very durable, and Manuka, Totara, Kauri, Black Birch, Kowhai, and Matai, appear to be the most highly esteemed on the whole.

The proportion of forest land to the whole country, as ascertained in 1873, was as under:—

	Percentage of Forest Land.
North Island—	
Auckland	7·20
Hawke Bay	8·19
Taranaki	65·56
Wellington	42·85
South Island—	
Nelson	28·86
Marlborough	18·38
Canterbury	2·07
Otago, Southland	11·84

Further particulars will be found in the table relating to the Crown lands of the colony, shown on the statistical map attached to this book.

Strength of New Zealand Timbers.

The following table gives the results of experiments, extending over a period of some years, made on the strength of the principal timbers of the colony:—

RESULTS OF EXPERIMENTS ON NEW ZEALAND TIMBERS.

[The dimensions of the specimens experimented on were 1 inch square and 12 inches long.]

No.	Native Names in Alphabetical Order.	Specific Gravity.	Weight of a Cubic Foot.	Greatest Weight carried with unimpaired Elasticity.	Transverse Strength.
			lbs.	lbs.	lbs.
1	Hinau, or Pokako (*Elæocarpus dentatus*)	·562	33·03	94·0	125·0
2	Kahika, supposed white pine	·502	31·28	57·3	77·5
3	Kahikatea, white pine (*Podocarpus dacrydoides*),	·488	30·43	57·9	106·0
4	Kauri (*Dammara australis*)	·623	38·96	97·0	165·5
5	Kawaka (*Libocedrus doniriana*)	·637	39·69	75·0	120·0
6	Kohekohe (*Dysoxylum spectabile*) ..	·678	42·25	92·0	117·4
7	Kowhai (*Sophora tetraptera* var. *grandiflora*).	·884	55·11	98·0	207·5
8	Maire, black maire (*Olea apetala*) ..	1·159	72·29	193·0	314·2
9	Maire (*Eugenia maire*)	·790	49·24	106·0	179·7
10	Mako (*Aristotelia racemosa*)	·593	33·62	62·0	122·0
11	Manoao (*Dacrydium colensoi*)	·788	49·1	200·0	230·0
12	Mangi, or mangeo (*Tetranthera calicaris*)	·621	38·70	109·0	137·8
13	Manuka (*Letospermum ericoides*) ..	·943	59·00	115·0	239·0
14	Mapau, red mapau, or red birch (*Myrsine urvillei*).	·991	61·82	92·0	192·4
15	Matapo, or tarrata, black mapau (*Pittospermum tenuifolium*).	·955	60·14	125·0	243·0
16	Matai (*Podocarpus spicata*)	·787	49·07	133·0	197·2
17	Miro (*Podocarpus ferruginea*)	·658	40·79	103·0	190·0
18	Puriri (*Vitex litoralis*)	·959	59·5	175·0	223·0
19	Rata, or iron wood (*Metrosoideros lucida*)	1·045	65·13	93·0	196·0
20	Rewarewa (*Knightia excelsa*)	·785	48·92	93·0	161·0
21	Rimu, red pine (*Dacrydium cupressinum*)	·563	36·94	92·8	140·2
22	Taraire (*Nesodaphne taraire*)	·888	55·34	99·6	112·3
23	Tawa (*Nesodaphne tawa*)	·761	47·45	142·4	205·5
24	Tawiri-kohu-kohu, or white mapau,	.822	51·24	80·0	177·6
25	(*Carpodetus serratus*) Titoki (*Alectryon excelsum*)	·916	57·10	116·0	248·0
26	Totara (*Podocarpus totara*)	·559	35·17	77·0	133·6
27	Towai, red birch (*Fagus menziesii*) ..	·626	38·99	73·6	158·2
28	Towai, black birch (*Fagus fusca*) ..	·780	48·62	108·8	202·5
29	Whawhako (see also Maire), (*Eugenia maire*)	·637	39·63	75·0	120·0
30	Whau (*Eutetia aborescens*)	·187	11·76	13·0	32·0

The experiments were conducted in the following manner:—A pressure of 50 lbs. was applied for two minutes (as measured by a sand-glass) and the sample was then released; 75 lbs. were then applied for the same time, and then 100 lbs., and so on, increasing by 25 lbs. each time. Each time the sample was released the point on the deflection scale to which it returned was read, and when it came to be notably under the original reading it was allowed to remain unloaded for two minutes, to see whether it would in time recover itself. Then the pressure was gradually increased, without being removed, until the specimen broke.

A particular description of 44 of the principal forest Trees will be found in the appendix.

The value of the export trade in timber for the decade 1868-77 amounted to £333,083, increasing from £15,653 in the former year to £50,901 in 1877, representing £25,660 for sawn-timber and £24,662 for logs, palings, shingles, and other timber.

BARKS FOR TANNING AND DYEING.

A number of the native forest trees and plants furnish good dyes from their bark. The natives were acquainted with most of these, and dyed their flax mats and baskets with them.

A black dye can be made from the bark of the hinau *(Elæocarpus dentatus)*, and by adding a rust of iron an excellent non-corrosive ink is obtained.

Brown and red dyes are obtained from the barks of the towai *(Weinmannia racemosa)*, a red dye from that of the atawhero *(Rhabdothamnus solandri)*. The native mode of producing this is by first bruising and boiling the bark for a short time, and when cold, the flax to be dyed is taken out and steeped thoroughly in red swamp mud, rich in peroxide of iron, then removed and dried in the sun.

The towai is a forest tree abundant in many parts of New Zealand. The bark has been successfully used as a tanning agent. The dye obtained from this bark gives a very fast class of shades upon cotton ; it can be sold at the same price as gambier and catechu. The extract is more astringent than that of the hinau, and needs only to be introduced to be accepted by tanners.

TAN BARKS NATIVE TO NEW ZEALAND.

Name.	Native Name.	Percentage of Tanin.
Bark of Phyllocladus trichomanoides	Kiri toa toa	23·2
„ Elæocarpus dentatus	Kiri hinau	21·8
„ Coraria ruscifolia	Tutu	16·8
„ Eugenia maire	Whawhako	16·7
„ Weinmannia racemosa	Tawhero	12·7
„ Elæocarpus hookerianus	Pokako	9·8
Wood of Fuchsia excorticata	Kotukutuku	5·3
Bark of Knightia excelsa	Rewa rewa	2·7
„ Myrsine urvillei	Mapau	1·4

PHORMIUM TENAX.

The New Zealand Hemp.

The history of what is termed the flax industry in New Zealand affords a remarkable instance of the difficulty experienced in developing the natural resources of a country if the commodities to be disposed of have not a previously established market value.

When the colonists first arrived in New Zealand, the valuable qualities of the phormium fibre were well known, as it was in constant use by the natives, and a very considerable trade in the article existed as early as 1828, when the islands were only visited by whalers and Sydney traders, £50,000 worth of the fibre being sold in Sydney alone between 1828 and 1832. At Grimsby, in Lincolnshire, a manufactory was also established in the latter year for the production of articles from the New Zealand fibre, which failed from some unexplained cause, notwithstanding that, the results were not considered at the time unsatisfactory. From 1853 to 1860 the average

annual value of the fibre exported was nearly £2,500, reaching as high as £5,500 in 1855, but up to this time the only fibre exported was that prepared by native labour, no machinery of any kind being employed in producing the exported article. In 1860, therefore, when the native disturbances affected the Waikato and other interior districts in the North Island, the preparation was confined to the native tribes north of Auckland, so that the average export value was only £150 per annum. Attention was then directed towards the contrivance of machinery with the aid of which the fibre could be profitably extracted by European labour. In 1861 the increasing demand for white rope, and the limited quantity of manilla, which fibre depends for its production on native manual labour in the Philippine Islands, led to a rise in its value from £21 to £56 per ton, and even to £76 per ton in America during the late civil war. These high prices stimulated the endeavour to introduce phormium fibre to compete with manilla, and several machines were invented for rapidly producing the fibre from the green leaf. With these machines the export trade again increased, so that from 1866 to 1871 the yearly average was valued at £56,000. This sudden revival of the trade led many to embark in it who were unacquainted not only with this new form of manufacture, but unaccustomed to any kind of business that required special mechanical skill and careful elaboration of the details of management.

Commissioners were appointed in 1869 and 1870 to investigate and report on the manufacture and cultivation of the plant and particular requirements of the market.

Recently the term flax has been changed to hemp, with great advantage to the position which the fibre holds in the brokers' sale rooms; but the fibre can be prepared so as to mix advantageously with true linum flax in the manufacture of textile fabrics, and the shortness of the ultimate fibre is not an insuperable obstacle even to its being spun into unmixed yarns. It will therefore, in all probability, be necesssry to adopt two names for the fibre to indicate the purpose for which it has been specially prepared, such, for instance, as phormium hemp and phormium flax. Samples of serge sheeting, canvas sacking, and other varieties of cloth, from unmixed phormium fibre, have been manufactured in Scotland and sent out to the colony, and also samples of a very superior kind of canvas made from an admixture of phormium with Riga flax. The fibre used in these experimental manufactures was prepared by Mr. C. Thorne by the use of alkaline solutions, and it is stated that such fibre would find a ready market in large quantities at from £60 fo £90 per ton. Whether this would be as profitable an application of the fibre as the production of hemp is, however, not yet established.

The total quantity of phormium exported between the years 1864 and 1876 amounted to 26,434 tons, valued at £592,218. The quantity exported in 1878 amounted to 622½ tons, valued at £10,666.

AGRICULTURE

Allusion has been made to the area of country occupied by mountain ranges in New Zealand, and the general position they occupy with reference to the geography of the country, and it may be further stated that, with the exception of the higher alps every part of the country is more or less adapted for settlement of some kind. A clearer idea of the value of the country, and the purposes to which it is applicable, is, however, obtained by the comparison of the rock formations, the decomposition of which produces

the soils, as shown in the following table; from a study of which it will be found that in the whole of the colony there are about 12,000,000 acres of land fitted for agriculture, wherein the form of surface is suitable, and about 50,000,000 which are better adapted for pasturage; but from these estimates allowance must be made for about 20,000,000 acres of surface at present covered by forest.

Classification of Geological Subsoil.

The following table gives a classification of the lands according to the geological subsoil:—

——	North Island.	South Island.	Totals.
1. Fluviatile drifts, one-third agricultural	8,447	6,286	14,733
2. Marine tertiary, two-thirds agricultural (rest pastoral)	13,898	4,201	18,099
3. Upper secondary, coal bearing, pastoral	2,390	2,110	4,500
4. Palæozoic, pastoral	5,437	20,231	25.668
5. Schistose, pastoral	—	15,308	15,308
6. Granite, worthless	—	5,978	5,978
7. Volcanic, one-sixth agricultural (rest pastoral)	14,564	1,150	15,714
Square miles	44,736	55,264	100,000

Varieties of Soil.

It would be beyond the scope of this description to give in detail the endless varieties of soil which are found in New Zealand, but attention may be drawn to the chief peculiarities. In the north of Auckland, including the lower portion of the Waikato Valley, light volcanic soils prevail, interspersed with areas of clay marl, which, in the natural state, is cold and uninviting to the agriculturist, but which, under proper drainage and cultivation, can be brought to a high state of productiveness. The latter are, however, almost universally neglected at the present time by the settlers, who prefer the more easily worked and more rapidly remunerative soils derived from the volcanic rocks.

North-western District.

In the western district, which extends round to Taranaki and Wanganui, the soil is all that can be desired, and is probably one of the richest areas in the southern hemisphere. The surface soil is formed by the decomposition of calcareous marls, which underlie the whole country, intermixed with the débris from the lava-streams and tufaceous rocks of the extinct volcanic mountains. The noble character of the forest growth, which generally covers the area, proves the productiveness of its soil, although at the same time it greatly impedes the progress of settlement.

North-eastern District.

In the central district of the North Island, from Taupo towards the Bay of Plenty, the surface soil is derived from rocks of a highly siliceous character, and large areas are covered with little else than loose friable pumice-stone. Towards the coast, and in some limited areas near the larger valleys, such as the Waikato and the Thames, and also when volcanic rocks of a less arid description appear at the surface, great fertility

prevails, and any deficiencies in the character of the soil are amply compensated for by the magnificence of the climate of this part of New Zealand. On the eastern side of the slate range, which extends through the North Island, the surface of the country is generally formed of clay marl and calcareous rocks, the valleys being occupied by shingle deposits derived from the slate and sandstone rocks of the back ranges, with occasional areas of fertile alluvium of considerable extent. It is only the latter portions of this district which can be considered as adapted for agriculture, while the remainder affords some of the finest pastoral land to be met with in any part of the colony.

South-eastern District.

In the South Island the chief agricultural areas are in the vicinity of the sea coast, but there are also small areas in the interior, in the vicinity of the lake districts, where agriculture can be profitably followed. The alluvial soil of the lower part of the Canterbury plains and of Southland are the most remarkable for their fertility; but scarcely less important are the low rolling downs formed by the calcareous rocks of the tertiary formation, which skirt the higher mountain masses, and frequently have their quality improved by the disintegration of interspersed basaltic rocks.

South-western Side.

On the western side of the island the rapid fall of the rivers carries the material derived from the mountain ranges almost to the sea coast, so that comparatively small areas are occupied by good alluvial soil; but these, favoured by the humidity of the climate, possess a remarkable degree of fertility.

By the proper selection of soil, and with a system of agriculture modified to suit the great variety of climate which necessarily prevails in a country extending over 12 degrees of temperate latitude, every variety of cereal and root crop may be successfully raised in New Zealand; and with due care in these respects, New Zealand will not fail to become a great producing and exporting country of all the chief food staples.

Progress of Agriculture.

The progress made in agriculture has been very rapid, and the number of persons engaged in this pursuit is, as compared with other countries, very large, about one in every five of the adult male population being in this way possessed of a permanent stake in the country. The number of holdings of one acre and upwards of cultivated land (exclusive of gardens attached to residences and Native holdings) enumerated in March, 1878, was 20,519, an increase of 1,769 on the year previous; and in February, 1879, the number of holdings had increased to 21,048. The exports of agricultural and farm produce increased from £262,930 in 1875, to £763,635 in 1879.

The pursuit of farming has, at any rate in the South Island, been one of the most steadily prosperous industries of the colony; and although, in the course of time, the value of first-class land has naturally much increased, it is a question whether such enhancement of price is not more than counterbalanced by the improved and cheaper facilities of access to market now offered; and certainly, when compared with the published accounts of the condition of agricultural affairs in

Britain, the prospect offered by New Zealand farming must present a tempting aspect to those engaged in struggling along in the same pursuit in the old country.

On the next page will be found, in tabulated form, an account of land in cultivation, and agricultural produce of the various provincial districts of New Zealand, showing the nature of the holdings, and the character of the cultivation for the past two years, indicating the increase or decrease respectively.

Average yield of Crops.

The average yield of wheat for the year 1878–9 was 22·94 bushels per acre for the whole colony, the average for the last five years being 27·62 bushels per acre.

For Otago, the average yield was	..	..	28·18 bushels
Canterbury „ „	..	..	20·83 „
Wellington „ „	..	..	24·47 „

The average yield of other produce for the same year, 1878–9, for the whole colony, was:—

Oats ..	..	..	..	..	30·11 bushels per acre
Barley ..	..	..	..	..	24·76 „
Potatoes ..	..	..	..	..	4·98 tons „

One of the statistical diagrams at the end of the book (No. XI.) will be found to give a graphic comparison of the wheat yield of New Zealand and Australian Colonies.

Account of Land in Cultivation and Agricultural Produce—Season, 1878-9.

(February, 1879.)

Provincial Districts.		Numbers of Holdings over 1 Acre in Extent.			Extent of Land broken up, but not under Crop.	In Wheat.		In Oats.			In Barley.		In Potatoes.		In Other Crops.	Total Number of Acres under Crop, exclusive of Land under Grasses.	In Sown Grasses.			
								Acres.									In Hay.			
		Freehold.	Rented.	Part Freehold. Part Rented.	Acres.	Acres.	Estimated Gross Produce (in bushels).	For Green Food or Hay	For Grain.	Estimated Gross Produce of Grain (in Bushels).	Acres.	Estimated Gross Produce (in bushels).	Acres.	Estimated Gross Produce (in tons).	Acres.		Acres.	Estimated Gross Produce (in tons).	In Grasses after having been broken up (including such as in Hay). Acres.	Grass-sown lands not previously ploughed (including such as in Hay). Acres.
Auckland	1879	3,980	648	318	34,922	6,635	158,293	7,800	4,048	100,437	369	9,721	4,170	17,737	6,407	29,429	11,927	14,155	213,055	227,723
„	1878	3,705	684	277	25,138	5,073	118,357	3,965	3,229	66,470	198	4,571	4,589	22,713	4,637	21,691	10,560	12,504	173,121	231,713
Taranaki	1879	562	197	124	2,158	2,265	57,786	141	1,797	59,602	170	4,812	534	1,965	350	5,257	1,854	2,904	24,542	69,392
„	1878	496	212	143	1,451	2,069	45,628	88	699	22,210	91	2,470	518	2,194	240	3,705	1,962	2,999	20,717	54,982
Wellington	1879	1,628	595	270	7,279	7,670	187,698	1,026	10,852	314,528	299	7,417	1,333	7,144	1,319	22,499	7,109	10,630	91,450	587,061
„	1878	1,544	549	216	38,068	5,891	159,121	673	6,523	182,907	367	9,687	1,324	7,113	402	25,180	5,826	8,247	77,298	500,354
Hawke Bay	1879	458	150	97	14,446	1,668	27,555	1,115	3,830	68,909	483	8,856	608	2,041	1,904	7,973	5,466	4,864	70,305	446,238
„	1878	436	165	93	9,729	678	16,596	631	2,055	51,272	334	9,456	617	3,441	707	5,022	3,646	4,159	57,504	379,094
Marlborough	1879	313	76	86	3,012	2,563	69,588	1,127	2,591	84,204	2,757	89,778	450	2,456	727	10,215	1,177	1,691	17,297	37,836
„	1878	315	74	64	4,394	3,017	74,389	897	1,668	45,448	2,865	72,528	419	2,349	332	9,198	718	885	15,227	29,205
Nelson	1879	774	481	241	5,499	3,224	61,955	3,465	3,013	75,138	2,345	56,585	1,008	4,636	2,563	15,558	3,802	4,783	36,639	57,068
„	1878	725	459	280	2,867	2,794	45,817	2,529	1,422	28,010	2,074	37,683	1,033	5,473	1,018	10,870	2,500	2,737	21,161	37,421
Westland	1879	161	106	15	314	...	...	373	8	180	...	...	208	789	68	657	182	249	2,581	5,437
„	1878	124	103	6	468	1	10	193	9	458	...	...	285	1,257	57	545	269	297	2,122	2,852
Canterbury	1879	2,996	1,124	563	120,483	173,895	3,621,820	15,188	128,384	3,237,462	17,062	371,009	4,614	26,767	97,161	436,304	11,749	10,864	479,725	115,354
„	1878	3,055	1,408	606	123,060	147,255	3,409,953	9,638	86,815	2,398,943	13,757	335,733	4,419	26,786	64,294	326,178	10,126	14,288	418,000	163,038
Otago	1879	2,895	1,561	635	77,404	66,941	1,885,904	19,073	123,508	4,416,690	5,181	161,287	4,390	22,651	70,825	289,918	10,237	14,380	315,557	100,651
„	1878	2,778	1,368	554	67,430	76,628	2,475,498	12,737	87,924	3,134,244	3,027	104,695	4,360	23,152	64,294	249,444	9,483	12,555	292,304	89,726
Totals	1879	13,762	4,938	2,348	265,512	264,861	6,070,599	49,187	278,031	8,357,150	28,666	709,465	17,315	86,186	181,264	819,445	53,503	64,520	1,251,151	1,646,758
„	1878	13,178	5,102	2,239	272,605	243,406	6,336,369	31,351	190,344	5,929,962	22,713	576,823	17,564	94,478	136,455	641,853	45,090	58,671	1,077,454	1,488,385
Increase in	1879	584	...	109	..	21,455	...	17,836	87,687	2,427,188	5,953	132,642	...	...	44,809	177,612	8,413	5,849	173,697	158,373
Decrease in	1879	...	184	...	7,093	..	265,770	...	...	...	...	...	249	8,292	...	...	...	..	...	...

PASTORAL PURSUITS.

The mildness of the winter season, which does not require that any special provision for the keep of stock during that period should be made, and the general suitability of the country for grazing purposes, and the growth of a superior class of wool, caused the attention of the early settlers to be much given to pastoral pursuits; grass lands were looked up as sheep or cattle runs. The success attending the pursuit enabled the runholders to a large extent to purchase the freehold of their runs, or the best portions of them; and by improvements in fencing and sowing with English grasses, which thrive remarkably well in the colony, the bearing capabilities of the land were increased many fold. While for the North Island there are considerable tracts of grazing ground with natural herbage, a large extent of the country consists of hill land of varying quality covered with forest or bush, as it is called in the colony.

This land, after the bush has been cut down and set fire to, if grass seed be sown upon the ashes, is converted in a few weeks into good grazing land. Much forest has already been destroyed in this manner, and the land supports large flocks and herds, and the same system will doubtless be extensively followed as a large portion of country that would be so used, is not available for agricultural pursuits. In the Middle Island the bush is chiefly confined to the western slopes of the dividing range; the open hills, plains, and downs to the east of the range being available for grazing purposes. The extent to which pastoral pursuits have been followed may be estimated by the quantity of stock in the colony in 1878 (when the census was last taken). The numbers of the undermentioned kinds were as follows:—

Horses	137,768
Cattle	578,430
Sheep	13,069,338

These numbers do not include the animals in the possession of aboriginal natives, no estimate of which can be given; while, however, possessing a considerable number of horses, they own but small numbers of sheep and cattle. The export of wool has grown, since the first settlement of the colony in 1839, to an export in 1877 of 64,481,324 lbs., estimated in value at £3,658,938. In ten years the increase in the quantity has been at the rate of 124 per cent.

While much of the country is only suited for sheep, a considerable portion is well adapted for the grazing of cattle. Much attention has been paid to, and capital expended on the improvement of the various kinds of domestic animals; and some of the sheep and cattle fattened on grasses only, may well bear comparison with the animals fattened on artificial food for the English markets.

The horses in the colony vary much in quality, for some years they realized such low prices that but little attention was paid to the breeding of good saddle horses, and as the Maoris possess large numbers of mares (not included in the census numbers), and bred from them without much regard to the improvement of stock, there has been a large increase in the number of small weedy animals. Where care has been taken, excellent results have been obtained. As both draught horses and thorough breds of the best strains of blood have been imported, first class animals of either sort are obtainable, and always command a good value.

The various large Agricultural Shows periodically held in different parts of the colony, and heartily supported by farmers, stock owners, and the general public, have done much to encourage the good breeding of horses and cattle, and all other kinds of stock.

WOOL.

Wool is, undoubtedly, the most important production of New Zealand, its value in export being more than double that of gold.

Wool is divided into two classes, combing wool and clothing wool; from which are produced the two leading kinds of manufacture in the cloth trade, viz.: worsted and woollen goods.

The first comprises the long stapled wools grown by the Lincoln, Leicester, Cotswold, and Romney Marsh breeds of English sheep.

They are required for worsted goods, and being combed for bombazines, camlet, &c. This is a class of wool for the production of which the soil and climate of New Zealand are very suitable. The long-wooled sheep of Great Britain improve by the change; the length of the wool is increased, and all its valuable properties preserved, owing doubtless to the genial climate and absence of exposure to the extremes of an English temperature.

The Leicester breed has received great attention in New Zealand, and is the favourite with the Auckland sheep farmers.

The Cotswold is a wool very similar to the Leicester, but of a somewhat deeper and harsher character, and lacks the "lustre" so much in demand for certain classes of manufactured goods. The Cotswold appears quite as much in favour with the New Zealand breeder as the Leicester, and probably its habits and character are more generally adapted to the climate of the South Island and the mountain pastures of the colony, than any other long wooled sheep. The Cotswold bears exposure better than the Lincoln or Leicester; will live and thrive on poor land, and come to more weight of carcass than any other breed.

The value of this breed as a cross with either Leicester or short-wooled sheep cannot be too much spoken of, and the favour in which crosses with the Cotswold are held, is a sufficient proof of their excellence.

The Romney Marsh partakes in a measure of the qualities of the Leicester and Lincoln, being a soft, rich, and good handling wool, rather finer in quality than the Leicester, and having the glossy or "lustre" appearance of the Lincoln. Wool of this description is much in demand for certain fabrics, and is much sought after in the French markets.

The Cheviot is a wool that has grown into considerable popularity of late years, and is largely used in the worsted manufacture. It is a small fine-haired wool, of medium length and moderate weight of fleece.

The varities of fabrics manufactured from these long staple wools are almost innumerable, and are perpetually varying according to the changes of fashion, though there are certain fixed kinds which may be interesting to mention; viz., *Says*, which is used for clerical and academical vestments, *Serge*, *Sateens*, light woven cloths for ladies dresses; *Reps* are heavier, and from the method of weaving have a transverse ribbed appearance; *Cords*, like the last, but with longitudinal ribs. *Moreens*, watered cloths. *Merinos*, finely woven cloths, originally made from the fine Spanish wool called merino. *Paramattas*, fine cloths originally made from the paramatta wool with silk warps, though now woollen. *Camlets*, thin plain-woven cloths. *Damasks*, *Shalloon*, and when made with cotton warps, producing crapes, coburgs, tammies, delaines, lasting, and Orleans cloths.

The second kind or clothing wool comprises the short stapled wool grown by the Southdown and Shropshire Down breeds of English sheep, and the Merino (Spanish) sheep, from which are manufactured woollen goods, including broadcloths and fancy kinds.

The Southdown is a short stapled fine-haired close growing wool, used chiefly for clothing purposes. The value of this breed to New Zealand sheep-

farmers consists mainly in the improvements which crossing with it impart to the carcase. Some breeders have crossed the Southdown with the Merino, and with cross bred Romney Marsh and Merino.

The Shropshire down is a breed which is growing every year into more importance. It produces a wool longer in the staple, and more lustrous than any other down breeds. It has been cultivated in New Zealand to a small extent only.

The Merino is the most valuable and important breed cultivated in New Zealand, and of sheep of this class the flocks of the colony are chiefly composed; they are of the Australian merino variety, improved through the importation of pure Saxon merino rams from Germany. The excellence of the Merino consists in the unexampled fineness and felting property of its wool, which in fineness, and the number of serrations and curves exceeds that of any other sheep in the world. Fine Saxon merino wool has 2,720 serrations to an inch, Merino wool 2,400, Southdown wool 2,000, and Leicester 1,850. These figures represent the felting properties of the various wools. The Merinos adapt themselves to every change of climate, and thrive and retain, with common care, all their fineness of wool under a burning tropical sun, and in cold mountain regions.

In New Zealand the length of staple and weight of fleeces have been increased, without any deterioration in the quality of the wool.

Of the fabrics manufactured from these kinds of wool may be mentioned *Doeskins*, technically called seven harness cloth. *Cassimeres* and *kerseymeres* are four harness cloths, that is, four instead of seven threads in warp and weft, and in the kerseymeres the web being subjected to an extra "milling" is rendered more compact. *Sataras*, ribbed cloths, highly dressed, lustred and hot pressed. *Venetians*, woven as twills. *Meltons*, stout cloths not dressed or finished except by paring. *Beavers*, *deer skins*, *diagonals*, or fancy cloths. *Bedford cords*, usually drab-coloured ribbed cloths, of great strength and durability. *Tweeds*, which are lightly felted, are mostly of Scotch manufacture.

Up to the present time the weaving industry in New Zealand has been confined to tweeds, plaiding, and blankets, and various woollen underclothing.

The value of wool exported in 1878 amounted to £3,292,807. The quantities and values for previous years will be found in the statistical tables.

ANIMAL LIFE.

Until the systematic colonization of the islands, New Zealand was very destitute of terrestrial or animal life suitable to the wants of civilized man, the only animals being a small rat, a dog (which had probably been introduced since the islands were peopled by the present race), and pigs, the produce of some animals left by Captain Cook and the navigators that succeeded him; through the agency of the early missionaries, and by whale ships, many useful animals and plants were then introduced. In more recent years all kinds of domestic animals, many of very high quality, have been imported, including valuable breeds of sheep and the American llama. Domestic poultry of almost every species has also been introduced, and, through the agency of the Acclimatization Societies, many species of game (such as hares, pheasants, partridges, black game, red grouse, quail, &c.,)

and a host of the smaller birds of Europe and other countries have been spread throughout the islands. The rivers, too, of New Zealand, which formerly produced only the eel and a few small salmonoid fishes of little value, are gradually being stocked with salmon and trout, both European and American, whilst perch, tench, and carp, have also been satisfactorily acclimatized.

There are now in New Zealand thirteen million of sheep, five hundred and seventy-eight thousand cattle, and one hundred and thirty-seven thousand horses.

WHALING.

New Zealand is the chief centre of the southern whale fisheries, and at certain seasons the less frequented harbours are visited by whalers for the purpose of refitting and carrying on shore-fishing and barrelling their oil. These are generally American ships, but Otago and Auckland whaling ships are also equipped by New Zealand owners. The sperm whale abounds in the region of the ocean lying to the N.E. of New Zealand, but stragglers are found all round the coast. In the open sea and to the south the most prized whale next to the sperm is the black whale, or tohoro (Eubalænus australis), which is like the right whale of the North Sea, but with baleen of less value. Along the shores the chief whales captured are the humpback (Megaptera) and Rorquals (Sibaldius), which become very abundant when not disturbed for a few years.

Value of Whale Oil and Fur Seal.

In 1875, 20,845 gallons of black oil were exported, valued at £4,100, and 7,775 gallons of sperm, valued at £2,894. In 1877, 15,047 gallons of sperm whale oil were exported, valued at £4,032.

The sea bear, or fur seal (Arctocephalus cinerius), is found in the remote parts of the coasts, about a thousand skins being taken every year by boating parties. In 1875 there were exported 2,767 seal skins, valued at £4,050; and in 1877 there were exported 1,503 seal skins, valued at £1,652.

FISHERIES.

The assemblages of fishes which we find in the New Zealand seas on the whole, represent the characteristic forms of the southern or Lusitanian province of European coasts, or, in other words, that our New Zealand fishes resemble those which are found on the coast between Madeira and the Bay of Biscay more than they do those which are caught about the north of Scotland. Of thirty-three sea fishes that are used as food in New Zealand, we have among the constant residents on all parts of our coast, the Hapuku, Tarakihi, Trevally, Moki, Aua, Rock Cod, Wrasse, and Patiki; and while the Snapper, Mullet, and Gurnet are only met with in the north, the Trumpeter, Butter Fish, and Red Cod are confined to the south. But, with the exception of the Patiki, or Flounder, and the Red Cod, none of these are representatives of fishes that are common even in the south of Britain, while from the more northern seas similar fishes are altogether absent.

In addition to those which remain throughout the year a very large number of the fishes on the New Zealand coast, owing to its geographical position, are pelagic in their habits, and roam over a wide range of ocean, visiting our shores only irregularly in pursuit of food. Of the edible fishes

of this class, by far the largest number are visitors from warmer latitudes, such as the Frost Fish, Barracoota, Horse Mackerel, King Fish, Dory, Warehou, Mackerel, and Gar Fish, while only the Ling, Hake, Haddock, and a few other fishes, which are rare, and worthless as food, are among those of more southern types which reach the New Zealand coast in their migrations.

There is, however, no reason to complain of any want of useful variety in the New Zealand fishes as compared with Britain, for we find that out of 208 species of fishes enumerated as occurring in the British seas, including many which are extremely rare or only occasional visitors, only forty are considered to have a marketable value. In New Zealand, notwithstanding our very imperfect knowledge, especially with regard to the gregarious tribes, which there is reason to believe inhabit shoals at some distance from land, out of 192 sea fishes, some of which are only known from single specimens, we have nearly as many varieties used for food as are brought to market in the British Islands.

Of 140 species of fish enumerated as found in New Zealand, 67 species are, so far as we know, peculiar to New Zealand ; 75 are common to the coasts of Australia or Tasmania, while ten species are found in New Zealand and other places, but not in the Australian seas. New Zealand Ichthyology thus presents a very distinct character, the thorough deciphering of which affords a wide field for future observation and scientific investigation.

The following is a list of the fishes which are chiefly met with in the market :—

Hapuku	.. Oligorus gigas
Kahawai	.. Arripis salar
Red Snapper	.. Anthias richardsonii
Snapper	.. Pagrus uuicolor
Tarakihi	.. Chilodactylus macropterus
Trumpeter	.. Latris hecateia
Moki	.. ,, ciliaris
Frost Fish	.. Lepidoptus caudatus
Barracouta	.. Thyrsites atun
Horse Mackerel	.. Trachurus trachurus
Trevally	.. Caranx georgianus
King Fish	.. Seriola lalandii
John Dory	.. Zeus faber
Boar Fish	.. Cyttus australis
Warehou	.. Neptonemus brama
Mackerel	.. Scomber australasicus
Rock Cod	.. Percis colias
Gurnard	.. Trigla kumu
Mullet	.. Mugil perussii
Sea Mullet	.. Agonostoma forsteri
Wrasse	.. Labrychthis bothryocosmus
Butter Fish	.. Coridodax pullus
Haddock	.. Gadus australis
Red Cod	.. Lotella bacchus
Whiting	.. Pseudophycis breviusculus
Ling	.. Genypterus blacoides
Turbot	.. Ammotrites guntheri
Brill	.. Pseudorhombus scaphus
Flounder or Patiki	.. Rhombosolea monopus
Sole	.. Peltorhamphus n. zelandiæ
Gar Fish	.. Hemiramphus intermedius
Grayling	.. Prototroctes oxyrhyncus
Smelt	.. Retropinna richardsoni
Kokopu	.. Galaxlas fasciatus
Minnow	.. ,, attenuatus
Sand Eel	.. Gonorhynchus greyi
Anchovy	.. Engraulis encrasicholus
Pilchard or Sardine	.. Clupea sagax
Sprat	.. ,, sprattus
Eel—Tuna	.. Anguilla aucklandii
Black Eel	.. ,, australis
Conger Eel	.. Conger vulgaris
Silver Eel	.. Congromuræna habentata
Leather Jacket	.. Monacanthus convexirostris
Smooth Hound	.. Mustelus antarcticus
Stingaree	.. Trigon thalassa
Skate	.. Raja nasuta

GEOLOGY.

The geological map and sections which were specially prepared to accompany the collections exhibited at Sydney by the Geological Department of New Zealand, indicate our present knowledge of the structure of the Islands and the distribution of the chief groups of rock formations, the leading features only being drawn on the reduced map which accompanies this work.

The following classification has been adopted in the construction of this map; but notwithstanding the large amount of Palæontological data that has been collected, the extent and rugged nature of the country and the very limited staff have precluded minute surveys being effected, so that the attempt now made to express the results obtained in a systematic form must be considered as merely provisional.

CLASSIFICATION.

		Approximate Thickness in Feet.
I.	Post Tertiary and Recent	
II.	Pliocene	1,500
III.	Upper Miocene	500 to 1,000
IV.	Lower Miocene	1,000 to 1,500
V.	Upper Eocene	500 to 700
VI.	Cretaceo-tertiary	2,000 to 5,000
VII.	Lower Greensand	500
VIII.	Jurassic	3,000 to 5,000
IX.	Liassic	2,000
X.	Rhætic and Trias	5,000 to 8,000
XI.	Permian	6,600 to 7,000
XII.	Lower Carboniferous and Upper Devonian	7,000 to 10,000
XIII.	Lower Devonian	5,000
XIV.	Upper Silurian	3,000
XV.	Lower Silurian	7,000 to 10,000
XVI.	Foliated Schists	
XVII.	Crystalline Rocks	
XVIII.	Granite	
XIX.	Plutonic and Dyke Rocks	
XX.	Basic Volcanic Rocks	
XXI.	Acidic Volcanic Rocks	

I.—POST-TERTIARY (RECENT).

a. Moa beds.
b. Alluvia.
c. Raised beaches, moraines, etc.

The deposits belonging to this period have accumulated with great rapidity in New Zealand, owing to the mountainous character of the country giving to the rivers, even when of large size, the character of torrents, which are liable to occasional floods of extreme violence. To some extent, also, the remarkable indications of change, which are everywhere manifest, must be attributed to alterations of relative level which have affected the surface, some of which have occurred during the present century. Such changes are more easily detected on the sea coast, where they effect sudden alterations of the shore line, but there is no doubt that they have been equally potent in inland districts, and have caused, for instance, marked changes in the courses of some of the rivers.

The Maori race is considered, from the evidence afforded by their traditions, to have been established in New Zealand for little more than 500 years before the first arrival of Europeans; but during that period, while the island was being explored in all parts by this intelligent and adventurous native race, the spread of fires, causing the destruction of the primeval forests and rank vegetation, was the means of setting free vast accumulations of loose soil and disintegrated rock that were formerly retained on the mountain slopes. The material thus displaced has accumulated in the river courses, causing them to raise their beds above the adjacent lands, so that they have broken away from their channels in many instances.

The race of gigantic Moa birds (Dinornis) had its maximum development in the New Zealand area, and subsequently became extinct during this period, but their extermination must have commenced at an earlier date than the first human occupation, as their bones are found deeply embedded in the gravels and swamps, while the evidences of human occupation are confined to the surface soil, shelter caves and sand dunes.

In a rugged and mountainous country like New Zealand, it would evidently be impossible, except on a very large scale map, to show the innumerable fringes of river beds, and other small patches of Post-tertiary deposits, and accordingly these have been neglected in the Geological map as exhibited, and the indication of the recent deposits have been limited to those places where the structural rock of the country is not exposed. These deposits, however, cover a considerable area of country in the Canterbury plains; the Mackenzie country; around the mouth of the Waitaki river, and in the Mataura, Waimea, and Five Rivers plains in the South Island; and in the Manawatu, Waikato, Thames, and Kaipara districts, and the isthmus between Awanui and North Cape, in the North Island.

II.—PLIOCENE.

a. Terrace plains, Scinde Island limestone.
b. Pumice sands and lignite series.
c. Kereru Rotella beds, Motanau, etc.

This formation belongs to a period when New Zealand was the mountain range of a greatly extended land area, and when, in the North Island, the volcanic forces had their greatest activity, attended with the rapid elevation of local areas of fossiliferous deposits that were forming in adjacent seas. In the South Island no marine deposits of importance, belonging to this period, are present, but the great area of land above the shore line intensified the erosive action of the glaciers radiating from the mountain centres, and gave rise to enormous deposits of gravel, such, for instance, as compose the greater part of the Canterbury plains, and the Moutere hills in Nelson.

The marine pliocene beds are characterised by the great abundance of *Rotella zealandica*, with *Dosinea anus*, *Struthiolaria fraseri*, *Chione*, and a large form of *Buccinum maculatum*, with many other forms.

The economic importance of this formation is very considerable, from its containing the richest deposits of alluvial gold that form the support of the mining population. The beds cover a considerable surface area, both in the North and also in the South Island.

In the North they form notable beds around the Manukau harbour; they cover a considerable area of country in the district between Alexandra

and the Upper Thames, and stretch from Lake Taupo towards Opotiki, fringing the coast between that point and Kati Kati. They also occur as an important deposit at Wanganui, where they are highly fossiliferous, and, stretching back from there to the head waters of the Rangitikei river, flank the Ruahine range, envelope the base of Tongariro and Ruapehu, and are subsequently traced as far as Lake Taupo, which they reach as a narrow strip on the banks of the Upper Waikato river. They further flank the Ruahine range on the east side, and extend north as far as Moeangiangi, and, besides appearing as isolated patches between, form the low hills surrounding Poverty Bay. Where they flank the Ruahine ranges, they have a great thickness, and being there of marine origin are highly fossiliferous; they have also been involved in extensive structural movements, so that in many places they have been completely overturned. Elsewhere they are nearly horizontal, although the marine beds have been locally raised to an altitude of 300 feet above sea level.

In the South Island their principal development is on the West Coast, between Lake Brunner and Bruce Bay; and in the Canterbury plains, where they fringe the range between Timaru and the Waipara river. They also occur in the Hurunui plains; around Lake Tripp; at the outlets of lakes Ohou, Pukaki, and Tekapo, fringing the older carboniferous rocks in the McKenzie country; from the Wanaka and Hawea lakes as far south as Wakefield; in the Manuherikia and Maniatoto plains; between lake Te Anau and the Mararoa river; and in the Southland plains, the greater part of which are composed of these beds.

III.—UPPER MIOCENE.

a. Wanganui series.
b. Manawatu Gorge.
c. Castle Point.
d. Taerua and Ross.
e. Waitotara and Awatere beds.

These beds are limited in their extent to the southern and eastern districts of the North Island, and in the South Island occur as patches, inland from Timaru, between Peel Forest and the Waitaki River; at the mouth of the Waipara; at Ross; south of Greymouth; and in Nelson, from Lake Roto-iti to the sea; but here, as at many other places, these beds are often represented by gravel conglomerates, that, from the absence of fossils, have not been distinguished from the preceding formation.

They consist of a series of sandy and argillaceous strata, the distribution of which, and as a rule also the mineral character, indicates that they were related to a closely adjacent shore line, as they often pass, almost suddenly, from coarse conglomerates into narrow strips of fine mud and clay, such as are deposited in the centres of deep channels and inlets.

The New Zealand seas have yielded about 450 species of existing shells, of which 120 have been found in this formation, together with 25 forms which are now extinct.

They are specially characterised by the occurrence of *Ostrea ingens*, *Murex octagonus*, *Fusus triton*, *Struthiolaria cingulata*, *Chione assimilis*, and *Pecten gemmulatus*.

IV.—LOWER MIOCENE.

a. Mangapakcha Valley.
b. Taipo, Awamoa, and Pareora beds.

This formation, which is distinguished from the foregoing chiefly by its fossils, is a calcareous and argillaceous formation, widely spread over the east and central part of the North Island, and both sides of the South Island, and, when not removed by denudation, can be traced to an altitude of 2,500 feet above the sea. It represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region, and for the abundance of marine life, about 55 existing mollusca and 110 extinct species having been obtained from this formation, amongst which *Dentalium irregularis*, *Pleurotoma awamoaensis*, *Conus trailli*, *Turritella gigantea*, *Buccinum robinsoni*, and *Cucullæa alta*, are the most notable.

The principal areas of development of these beds are up the Wanganui River; between the East Cape and Wairu Bay; between Tokomarua and Tolago Bay, and inland from there to Waipaoa; while on the east coast of Wellington they occur as a long strip, reaching nearly to Cape Kidknappers.

In the South Island they occur in several localities, as at the Port Hills, Nelson; between the Awatere River and Cape Campbell; in the Cheviot Hills, and reaching south from there to Mount Grey; between Marsden and Inangahua, following the course of the River Grey; and as a narrow strip between Waimate and Geraldine. They also occur as several small patches which require no special mention. In some places deposits of an inferior quality of coal occur in this formation.

V.—UPPER EOCENE.

a. Mount Brown beds.
b. Hutchinson's quarry beds.
c. Nummulitic beds.

This is a very marked formation of calcareous sandstone, composed of shell fragments, with corals and bryozoa, and is a shallow water and littoral deposit.

Intense volcanic activity prevailed during this period in both Islands, and the calcareous strata are frequently interbedded with contemporaneous igneous rocks and tufas, and in the North Island are often replaced by wide spread trachyte flöes and volcanic breccias.

The lower part of this formation passes, at places, into an imperfect nummulitic limestone, or a friable calcareous sandstone, evidently deposited in shallow seas, and forming the lowest member of the proper marine tertiary series.

The more noticeable fossils in this formation are *Strutholaria senex*, *Pecten hutchinsoni*, *Pecten hochstetteri*, *Terebratella suessi*, *Meoma crawfordi*, *Bryozoa*, and numerous corals.

The distribution of these beds is limited in area, the principal development being about the Waiau river, in Southland; and on the eastern side of the Te Anau Lake; with a few patches up the East Coast of the South Island, at Oamaru, Geraldine, Mount Somers, and Mount Grey; while in the North Island they are principally developed from Cape Kidnappers south, and inland up the Tukituki river; a small patch of the same beds also occuring at Mokau.

VI.—CRETACEO-TERTIARY.

a. Grey marls.
b. Ototara and Weka Pass Stone.
c. Fucoidal greensands.
d. Amuri limestone, chalk marls, and chalk with flints.
e. Marly greensands.
f. Island sandstone (Reptilian beds).
g. Black grit and coal formation.

These constitute the Cretaceo-tertiary group, being stratigraphically associated and containing many fossils in common throughout, while at the same time, though none are existing species, many present a strong Tertiary facies, and in the upper part only a few are decidedly Secondary forms.

The distribution of this formation shows that it was not, like formations of later date, deposited in relation to the form of the land as at present obtaining in the New Zealand area, except in the vicinity of some of the oldest and most lofty land masses in the south, which appear to have remained above the water-line from the Lower Cretaceous period.

The upper part of this formation is a deep sea deposit, but the lower sub-divisions indicate the close vicinity of land, and are replaced in some areas by true estuarine and fluviatile beds containing coal.

The marine fossils include, besides well-marked Greensand forms, such as *Ancyloceras*, *Belemnites*, and *Rostellaria ;* a number that have still a marked affinity to the tertiary fauna. Saurian bones occur, of the genera *Plesiosaurus*, *Mauisaurus*, *Leiodon*, etc., in this part of the formation, but they have only been found, as yet, over a limited area on the east side of the South Island.

The black grit, which is the lowest marine bed of this group, resembles, in mineral character and the contained fossils, the Car-stone and Calcareous Greensand of England.

In the upper part of this formation the valuable building stone, known commercially as the "Oamaru stone," occurs, which is a calcareous sandstone very easily worked, but which hardens when exposed to the weather.

The principal coal deposits of New Zealand occur in the Cretaceo-tertiary formation, but always at the base of the marine beds of the formation, in every locality where they occur. The coal bearing beds always rest upon the basement rock of the district, marking a great unconformity and the closing of long persistent land area at this period.

Thus the coal is immediately overlaid by the Grey-marls in the Waikato, by the Fucoidal greensands at Wangarei, and by the Island sandstone in Otago and on the west coast of the South Island.

The coals immediately beneath the marine beds are everywhere hydrous brown coals, but on the West Coast these rest upon an immense formation of micaceous sandstones, grits, and conglomerates, in which are seams of valuable bituminous coal, and this lower part of the formation is possibly the equivalent in time of the Lower Greensand Group.

The same fossil plants are found associated with all these coal deposits, and even those of highest antiquity abound in the fossil remains of dicotyledonous and coniferous trees of species closely allied to those represented in the existing flora of the country.

In the Malvern hills, where the strata overlying the coal contain abundance of Lower Cretaceous fossils, the dicotyledonous leaves are associated with *Alethopteris*, *Oleandridium (Taeniopteris)*, and other forms that are prevalent in the underlying Jurassic beds. The same association takes place in the sandstones overlying the coal on the West Coast.

It appears from this that the land surface preceding the great depression during Cretaceo-tertiary times, survived to a later date in the north than in the south of New Zealand, the beds overlying the coal in the north being generally of younger Cretaceous age.

This formation has a large distribution from north to south, but coal is only found at its base in a limited number of localities.

At Kawa-kawa, and between that point and Wangarei, coal has been found, and again in the Waikato, at Kawhia, and Mokau, but on the east side of the North Island coal seams are yet unknown, associated with these beds.

In the South Island the whole series of beds occur in disconnected areas from Collingwood to the Grey river, being in every case associated with coal, and at the Abbey rocks thin coal seams also occur, associated with these beds.

At Preservation Inlet some divisions of the formation are found, as also at the Nightcaps; on the Mataura; at Kaitangata and Green Island; in every case associated with coal; while from Shag Point up to the Waitaki river they have a further development.

Several other patches occur going northward, and, as a rule, coal seams occur at their base until reaching the Malvern Hills, but north of this point, as at the Amuri Bluff, they pass down conformably into the next described formation.

VII.—LOWER GREENSAND.

a. Amuri group on East Coast.
b. Bituminous Coals on West Coast. (?)

These beds consist of green and grey incoherent sandstones, with hard concretions, and large masses of silicified wood.

This formation, which is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few Saurian bones and large Chæmeroid fishes. Its typical development is at the Waipara and Amuri Bluff, but equivalent beds are also found on the east coast of the North Island in several localities, and they have a considerable development in the neighbourhood of East Cape, extending inland as far as Hikurangi.

VIII.—JURASSIC.

a. Mataura series.
b. Putataka series.
c. Flag Hill series.

These beds, which are the youngest of the Lower Secondary formation in New Zealand, require mention under their several subdivisions, although on the general map no distinction has been made between them.

The Mataura Series consists largely of estuarine beds, marine fossils being absent or rare. It consists of dark-coloured marls and fine-grained sandstones, and contains the fossil remains of a number of plants, of which eight species have been recognised. Amongst these are *Camptopteris*, *Cycadites*, and *Echinostrobus*, which connect these with the plant beds of the next lower formation. Those found at Waikava and Mataura Falls are especially interesting from at least one species being identical with a plant found in the Rajmahal beds of India, which are considered to be of Liassic age; viz., *Macrotæniopteris lata*. The same plants are found in

the Clent Hills plant beds, and from the natural sections, and also from the very characteristic fossils immediately below them, there can be no doubt that they should be referred to the Upper Oolite period.

The Putataka Series, which has its typical development at Waikato Heads as marlstones, is represented in southern districts by coarse-grained sandstones, which pass near the base of the formation into conglomerates with bands of indurated shale, enclosing plant remains and irregular coal seams, which have been included in the next group as its upper member.

The Putataka beds are of marine origin, and contain Middle Oolite fossils, of which eleven species have been identified.

The Flay Hill Series, which is principally developed in the Hokanui range, Southland, is marine, and is characterised by eighteen forms of fossil shells which have been identified; besides many others which have yet to be examined.

The Brachiopoda are interesting, as besides seven forms of *Rhynchonella*, and three of *Terebratula*; *Spiriferina rostratus*, of the Lias, is abundant, and also a form of *Epithyris* (i.e., a *Terebratula* of the type *T. elongata*), which is not hitherto recorded higher than of Permian age.

The distribution of these beds, as at present known, is confined to the Hokanui Ranges, and a block of country on both sides of the Waikawa River, and extending inland to the Mataura Falls, as well as a narrow strip on Catlin's River, in Southland; a small patch at Amuri Bluff; another at Kawhia and the Waikato Heads; and a strip of country running from Raukokore, in the Bay of Plenty, in the direction of the Waikare Moana Lake.

The minor subdivisions of these beds have as yet only been made in the Hokanui ranges.

IX.—LIAS.

Catlin's River and Bastion Series.

This formation consists in its upper part of conglomerates and sandy grits, with plant remains too indistinct for identification; and in the lower of marly sandstones in banded layers of different colours, at the base having a concretionary structure, which has led to their being termed the "Cannon-ball sandstone," and similar sandstones also occur in the Otapiri formation.

Fossils are plentiful, and divide the strata into distinct horizons, *Ammonites* being especially common; fifteen species have been determined, but a large number of others are present which have not yet been identified.

The general facies of the fauna is on the whole Liassic, although many Lower Oolite forms occur; but the Brachiopoda, of which twenty-one forms have been provisionally distinguished, again present the same abnormal survival of older types, especially in the occurrence of an *Athyris*-like shell belonging to a new sub-genus, *Clavigera*, which has a great development in the next lower formation.

Our knowledge of this formation is confined to the Hokanui range and the country between Gore and the sea coast at the mouth of Catlin's river; but no doubt, when beds of about this age are examined in detail elsewhere, they will be found to have a much greater development than is at present ascribed to them.

X.—TRIAS.

a. Otapiri series.
b. Wairoa series.
c. Oreti series.

It has been found necessary to include in this formation a thickness of strata which is quite unusual in other parts of the world, but the close connection which exists throughout, founded both on Palæontological and stratigraphical grounds, and the clearly defined Permian character of the next underlying formation, renders this classification absolutely necessary.

The Otapiri series consists of a group of strata which I place in Upper Trias, or more properly as an equivalent of the Rhætic formation, and is remarkable for the mixed character of its fossils, which however contain many forms identical with those from the Rhætic formation of the European Alps.

This mixed character is shown by the presence of *Belemnites otapiriensis*, which is near to *B. elongatus* of the English Lias, along with *Pleurotomaria ornata*, and *Tancredia truncata*, which are Oolite forms, associated with a preponderance of Triassic and even Permian forms, fourteen species of which have been determined, amongst which are *Nautilus mesodiscus* and *Nautilus goniatites*, cephalapoda, found in the Hallstadt or Rhætic beds of Europe.

The remarkable feature of the Otapiri series is the abundance of Brachiopoda, which are elsewhere so rare in formations of this period, but, as might be expected, they are chiefly peculiar forms—*Clavigera*, which has seven species, representing the genus *Athyris*; and a sub-genus of *Spiriferina*, which I name *Rastelligera*, with five species, being almost entirely confined to this formation. Plant remains also occur.

The Wairoa series has been generally admitted to be Trias since it was first described by Dr. von Hochstetter as characterized by *Monotis salinaria*, *Halobia lomelli*, etc. Eleven species have now been determined, and Brachiopoda are represented by the earliest appearance of *Clavigera* and *Rastelligera* and a form allied to *Spiriferina*, but having the dental plates conjoined with the rostral septum *(Psioidea)*, but they are very rare.

In some districts the Wairoa series is divided into two horizons, yielding marine fossils, separated by sandstones containing fossil plants, from which forms of *Glossopteris*, *Zamites*, and *Rhacophyllum* have been obtained.

The *Oreti series*, which has been mentioned in the reports as the Lower Wairoa series, has since been shown to be absent in the Wairoa district, so that it is advisable to give it a distinct name. It includes a great formation of green and grey tufaceous sandstones and breccias, having at its base a remarkable conglomerate of enormous masses of crystalline rocks, in a hard cementing matrix, resembling the character described for the base of the Gondwinda series in India. Some of the blocks, which are both angular and rounded, are 5 feet in diameter.

This conglomerate has a thickness varying from 50 feet to 400 feet, and is never absent from its proper sectional position in any part of the Hokanui District. The strata have been termed "ash-beds" on account of their tufaceous and brecciated character.

The fossils are chiefly Permian and Triassic forms, but a *Pentacrinus* also occurs, which resembles the Jurassic species. Brachiopada are scarce, except one form of true *Athyris*, of which specimens are very abundant; with two species of *Psioidea*, and four species of *Rhynchonella* with smooth external surfaces, which only occur in collections from these beds in the Kaihiku Ranges.

These Triassic beds are best known in the Moonlight and Hokanui ranges in Southland, and extending as a narrow strip to the sea coast at Nugget Point. They also occur at the Wairoa Gorge, in Nelson, where they were first discovered by Dr. v. Hochstetter; but they are also found in the Jollie Range at the head waters of the Rakaia and Rangitata rivers; bounding the Hanmer Plains and forming the Lowry Peaks; and also at the mouth of the Dillon River, and at the gorge of the Ashley where the limestones are highly fossiliferous.

In the North Island they occur in the vicinity of Wellington, and also between Cape Palliser and Palliser Bay; and are found, further north, flanking the Western side of the Hakarimata Range, where the Raglan track crosses it. The boundaries of these beds, except in Southland and at the Wairoa, may yet require modification, but in those places the beds have been traced with considerable care.

XI. PERMIAN.

Kaihiku Series.

The mineral character of this formation is grey and green sandstone with breccia and heavy conglomerate beds. Marine fossils have only been found at 1,000 feet below the great conglomerate that divides it from the Oreti series, the lower 5,000 feet, not having yet been discovered to be fossiliferous.

The leading fossils are Permian species, of which a large number have been recognised, and the greater number which have been found in Southland, also occur in Mount Potts and Nelson, where beds of the same age are present. *Trigonotreta undulata* is a common and characteristic form.

Saurian remains are associated with these beds at Mount Potts, which in 1877 I referred to *Ichthyosaurus*, but have since referred to the genus *Eosaurus* of Marsh. The further remains obtained of this Saurian, are, however, of such gigantic size as compared with the original types found in Nova Scotia, in which the vertebra were 2½ inches in diameter, that the determination may be doubted.

They comprise vertebra, limb bones, and ribs lying parallel; external to which are horny plates like dermal scuta. The vertebra are circular, biconcave, and deeply excavated, so as to be almost perforated in the centre. The diameter of the centrum must, in some cases, have been 18 inches, and the length or marginal thickness of the disk, 3 inches, so that the length to the width of the vertebral segments was 1 : 5. Still having the same proportions are other centra, but only 1 inch in length and over 6 inches in diameter. The articular surface of the bone is marked with irregular vascular channels, radiating from the centre, and the external surface of all the bones also shews this channelled character. No vertebral processes are visible. The ribs, which are strongly curved, are in some cases 3½ feet in length and 2¼ inches in diameter. The articular extremity is hatchet-shaped, with a convex surface. The proximal part of the rib looks like a hollow tube, probably owing to the spongy bone having disappeared, leaving the dense surface layer; but the distal portion of the rib for three-fourths of its length was solid throughout.

Thirty ribs were counted in one specimen, but it was not clear if they belonged to one side only.

The only limb bone available for examination is like the humerus of *Ichthyosaurus*, but greatly expanded at the distal extremity, being 11 inches in length and 9 inches across the lower end. It is compressed and concave on the one surface, and convex on the other.

The supposed scuta can only be seen in section; they are several inches in length and $\frac{1}{5}$ inch in thickness.

Until these remains are in a better condition for examination, it is impossible to suggest the order to which they have an affinity. Professor Huxley has expressed the opinion that Eosaurus may be a large *Labyrinthodon*. The very feeble limb bones, in proportion to the size of the vertebra, and the presence of dermal plates and hatchet-head ribs, tends to this view rather than to refer these remains to *Ichthyosaurus*, to which genus they are, on the other hand, clearly related, by the large number of vertebra and closely placed ribs; but until more distinct characters are found, and especially in the absence of teeth, none of which appear in the collection, it would hardly be justifiable to refer such gigantic vertebra to the amphibean type.

It is worthy of note that from a formation of the same age, near Nugget Point, Otago; and also in the Otapiri series in the Wairoa district, Nelson; teeth having *Labyrinthodont* characters have been obtained.

The occurrence of these Saurian remains, together with the survival of many Permian forms into the Wairoa and even the Otapiri series, and the absence of true *Spirifers*, *Productus* and other usual Palæozoic elements of a Permian fauna would seem to connect the Kaihiku series rather with the Mesozoic than the Palæozoic formations of New Zealand,

At the base of the Kaihiku series are the *Glossopteris* beds of Mount Potts, but these were not found in the Hokanui section, although from the thickness of the strata the relative beds must be included in it, while in the Kaihiku, *Glossopteris* occurs in the lower beds as developed in Popotuna gorge.

The distribution of these beds, so far as at present proved by fossils, is confined to the South Island, where they have been recognised in the Hokanui Ranges, extending from there to the coast at Nugget Point; in Mount Hamilton, and in the Mount Potts district, where they cover a considerable area, included between two belts of carboniferous rocks in that district; and they are found again as a small patch in the Wairoa district of Nelson.

XII.—LOWER CARBONIFEROUS AND UPPER DEVONIAN.

a. Maitai series.

b. Te Anau series.

This formation is of considerable importance from the large share it takes in the structure of the great mountain ranges and from the occasionally great development in it of contemporaneous igneous rocks, with which are associated metalliferous deposits. In the upper part this formation consists of fine grained argillaceous slates (Maitai slates of Hochstetter), becoming calcareous and passing into true limestones at their base. These limestones, which close the Maitai series, contain the following Lower Carboniferous fossils:—*Spirifera bisulcata*, *S. glaber*, *Productus brachythærus*, *Cyathophyllum*, and *Cyathocrinus*.

Succeeding these is the Te Anau series, which should probably be considered as Upper Devonian, but from the absence of fossils it has not been distinguished on the map.

It comprises an enormous thickness of Greenstone breccias, Aphanite slates, and Diorite sandstones, with great contemporaneous flöes and dykes of diorite, serpentine, syenite, and felsite.

These beds occur in the Longwood range; the Takitimu mountains; and between the mouth of the Molyneux river and Martin's Bay, occupying the area between the Te Anau and Wakatipu lakes.

In Northern Otago and Canterbury they form a continuous belt of country from Palmerston to Mount Cook, embracing the whole of the McKenzie country; and from there north they are found in the Tyndal range; at Browning's Pass; the Spencer mountains; St. Arnaud mountains; and thence through Nelson to D'Urville Island, and, taking in a large area of the Marlborough province, reappear from below the Permian rocks in the Kaikoura mountains. They are also found on the eastern side of the Permian rocks at Geraldine; Mount Peel; the Palmer range; Big Ben range; Okuku range, crossing the Hurunui river, and appearing on the edge of the Hanmer Plains. They are again seen in the Paparoa range at Greymouth, and extend from a point a little west of Mount Herschel, through Reefton and Lyell to the Tasman mountains and Anatoki range near Collingwood.

In the North Island their principal development is through the Rimutaka, Tararua, Ruahine, and Kaimanawa ranges, and thus on to the Whakatane country, where they reach the sea coast between Opotiki and Kotiki point. They also occur as several isolated patches more to the westward, between Tuhua and Rangitoto; in the Hakarimata, Pataroa, and Wairoa ranges, and again at the Thames and Cape Colville peninsula; and, appearing once more at Wanganui extend from there along the coast line to the Bay of Islands, also appearing in the same district as several isolated patches.

XIII.—LOWER DEVONIAN.

Reefton Beds.

These, as determined by their fossil contents, have only been distinguished in one locality, viz., Reefton, although from their mineral character they are evidently present in many other parts of the South Island.

They consist of alternating beds of quartzite, chert, and limestone, the latter yielding many fossils, of which *Spirifera vespertillio* and *Homolanotus expansus* are the most characteristic forms.

XIV.—UPPER SILURIAN.

Baton River Series.

A great part of the area coloured on the map as metamorphic schists should probably be included in this formation, but it has only been distinguished by its fossil contents in the north-west district of Nelson, where both Upper and Lower Silurian rocks are present.

The Upper Silurian rocks consist of grey cherts, sandstones and calcareous slates, with occasional beds of blue limestone.

In the Baton River they contain a great variety of fossils in the calcareous strata, and not infrequently in the sandstones and cherts, of which thirteen species have been determined, besides which a great variety of corals and corallines occur; crinoids also are very abundant.

Some few of the species are identical with those found in the Lower Devonian beds of Reefton, whilst others occur in the Lower Silurian rocks of America, but the prominent facies of the collections is undoubtedly Upper Silurian. The characteristic fossils are *Spirifera radiatus*, *Stricklandia lyrata*, *Pterinea spinosa*, *Murchisonia terebralis* and *Calymene blumenbachii*

XV.—LOWER SILURIAN.

Mount Arthur Series.

These rocks form the mass of Mount Arthur, and the range to the north-east as far as Separation Point, and they consist chiefly of a dark bituminous slate, associated with a blue or grey sub-metamorphic limestone, which is in places developed to a very large extent. White crystalline limestones are also associated with these beds throughout the whole length of the district from Mount Owen to Motueka.

The whole series is disturbed by eruptive hornblendic, and syenitic rocks, which are probably of Devonian age.

Fossils have been found in two localities only, and these consist entirely of *Encrinite* remains, and one species of coral not yet determined, and a few *Graptolites* which occur in the slates.

The central axis of these beds consists of true mica schists, to the east and west of which the limestone and bituminous slates overlie.

XVI.—FOLIATED SCHISTS.

The metamorphic rocks under this division have as yet been only sub-divided according to their mineral character; but they probably consist chiefly of altered Silurian rocks, and even those of formations as young as the Maitai or Lower Carboniferous beds.

They occupy the central portion of the Otago district, where they have an area of nearly 8,000 square miles, and from thence they crop out along the western flank of the central range through Westland and Nelson, a detached area also appearing in the Marlborough district, between Queen Charlotte Sound and the Pelorus. They are unknown in the North Island.

They have been subdivided as follows :—

Upper—A grey arenaceous, almost slaty rock, containing but little quartz, in the form of veins and laminæ.

Middle—Soft blue slates, often highly micaceous, and intersected with quartz veins of small size, the quartz being often rotten and decomposed. The thickness of this formation is not more than from 500 to 1000 feet, and it is probably the same from which most of the gold in the western, or Lake Gold Fields has been derived, by the direct erosion of glaciers and mountain torrents. This blue slate formation has been removed by denudation from the greater part of the central boss, only remaining in a few localities that are difficult of detection on account of its soft and perishable nature.

Lower contorted schist. This is a clay schist, foliated, not with mica nor felspar, but with quartz. It is often chloritic, when veins of magnetite occur in it, and also crystals of that mineral disseminated through the mass, and in the upper part the quartz is nearly wanting.

The schists, apparently, lie very flat, and cover a great extent of country. The foliated quartz does not commence at a distinct horizon, but beds thus altered occur in the regular sequence of the strata, separated by quartzless rock; in the lower part of the series, however, as exposed in the deep valleys that cut right through the central district of Otago, the whole mass of schist is intersected by concretionary laminæ of quartz (generally of a bluish tinge and horny appearance) that conform to the planes of foliation as in mica schist. Gold occurs segregated in the interspaces of this contorted schist, but it is rarely found *in situ*. Quartz reefs are confined to the upper schists, but there are few instances of other than true fissure reefs having been discovered, that is reefs that cut the strata nearly vertically, and have a true "back" or wall independent of the foliation planes, and filled with brecciated material.

XVII.—CRYSTALLINE SCHISTS.

The south western portion of the District of Otago is composed of crystalline rocks, forming lofty and rugged mountains, of which the chief characteristic is their cubical form, due to their being intersected in all directions by profound but narrow valleys, with abrupt precipitous sides to three-fourths of the extreme height of the adjacent mountains. The valleys are occupied on the west by arms of the sea, and on the east by those of inland lakes that resemble the Norwegian fiords, and present most wonderful mountain scenery.

The base rock of this formation is foliated and contorted gneiss corresponding to Humboldt's gneiss granite of South America, and associated with it are granite, syenite, and diorite, which belong to the next group.

Wrapping round these crystalline strata, and sometimes resting at an altitude of 5,000 feet on its surface, is a series of hornblende schists, soft micaceous and amphibolic gneiss, clay slate and quartzites, associated with felstone dykes, serpentine, and granular limestone. I believe these latter to be metamorphic rocks of not very ancient date, probably of Devonian age.

XVIII.—GRANITE.

Areas within the crystalline schists where true granite occurs, either metamorphosed, or in the form of perfect dykes, have been distinguished under this group.

Granites of a light grey colour, and very fine grain, are found in the Nelson and Westland districts, forming isolated hills along the boundary of the foliated schists on the east, and Lower Devonian beds on the west. In the south-western extremity of New Zealand, at Preservation Inlet, coarsely crystalline granites, of white and flesh colour, appear to break through and overlie the younger members of the crystalline schists.

IGNEOUS ROCKS.

XIX. *Plutonic and Dyke Rocks.*
XX. *Basic Volcanic Rocks.*
XXI. *Acidic Volcanic Rocks.*

Or, if grouped according to age, as in the geological sections—

A. Volcanic group. Recent and Post-Tertiary.
  a. Basaltic.
  b. Rhyolitic.
B. Trachytic group. Eocene.
  a. Trachyte Porphyries.
  b. Trachyte Breccias.
C. Dolerite group. Upper Cretaceous.
  a. Trachy-dolerites.
  b. Anamesites.
D. Propylite group. Lower Cretaceous.
E. Diabase group. Triassic.
F. Diorite group. Lower Carboniferous.

The igneous rocks have played an important part in almost every formation in New Zealand, marking great movements of the earth's crust at the different geological periods, while the superficial and later formed volcanic rocks occupy nearly one-third of the area of the North Island.

They are divided on the map into the above groups, of which the Plutonic and Dyke Rocks include Syenite and Diorite, with associated Breccias, Serpentine, and Olivine rocks (Dunite), the eruption of which took place in the Upper Devonian period.

These rocks are found on a line, which extends almost continuously through the South Island, but Diorite rocks reappear in the extreme north of Auckland, and on the Cape Colville peninsula, and Great Barrier Island. They are generally more or less metalliferous, chrome and copper being the ores of most frequent occurrence.

Basic Volcanic Rocks.—These belong to three distinct periods, when there were active eruptions, attended both by the formation of flöes of compact igneous rocks and tufaceous breccias.

The earliest of these occurred during the Triassic period, and consists chiefly of Diabase and Serpentinous breccias. The next eruptions took place about the close of the Jurassic period, along on the eastern base of the Canterbury Alps, where the rocks occur in dome-shaped mountains as melaphyres associated with felsite (quartz) porphyries which belong to the next group.

In the Cretaceo-tertiary period are massive trappean eruptions of trachydolerite and dolerite, while in the same period must be placed the propylite group, consisting of greenstone-trachytes, and fine and coarse-grained breccia rocks, which form the matrix of the auriferous reefs of the Thames goldfields.

In Eocene times dolerite flöes were contemporaneous with the limestones of the period of the Hutchinson's Quarry beds, while lastly in this group has been placed the Basaltic lavas of Pliocene age in the northern parts of the colony.

Acidic Volcanic rocks.—The rocks belonging to this group have a similar distribution in time to the foregoing, the earliest being the Felsite (quartz) porphyries, while Trachyte porphyries and breccias played an important part during Cretaceo-tertiary and older Tertiary periods, scoriaceous lavas and rhyolites being the characteristics of the later outbursts which have continued down almost to the present time.

The geysers and boiling springs in the North Island give rise to the formation of siliceous sinter, which must be included as the most purely acidic products of volcanic action, and are due to the decomposition of the older rocks by the action upon them of fresh water; but in the case of White Island and other localities, where the decomposition is brought about by the agency of sea water, the sinter deposits are formed chiefly of sulphate of lime and not silica.

MINING AND GEOLOGY.

Economic Minerals.

COAL.

Coal mines are being worked in the provinces of Auckland, Nelson, Canterbury, Otago, including Southland.

The different varieties of coal may be classed as follow :—

Class I.—*Hydrous*, containing an excess of combined water.
- Lignite.
- Brown coal.
- Pitch coal.

Class II.—*Anhydrous*, containing very little combined water.
- Glance coal.
- Semi-bituminous coal.
- Bituminous coal.

I. Hydrous, containing 10 to 20 per cent. of permanent water.

Lignite shows distinctly woody structure; laminated, very absorbent of water.

Brown Coal rarely shows vegetable structure, fracture irregular, conchoidal, colour dark brown, lustre feeble, cracks readily on exposure to the atmosphere, losing 5 to 10 per cent. of water, which is not reabsorbed, burns slowly, contains resin in large masses.

Pitch Coal.—Structure compact, fracture smooth, conchoidal, jointed in large angular pieces, colour brown or black, lustre waxy, does not dessicate on exposure nor is it absorbent of water, burns freely, and contains resin disseminated throughout its mass.

II. *Anhydrous Coal*, containing less than 6 per cent. of water.

Glance Coal.—Non-caking, massive, compact or friable, fracture cuboidal, splintery, lustre metallic, structure laminated, colour black, does not form a caking coal, but slightly adheres. This variety is brown coal altered by igneous rocks, and presents every intermediate stage from brown coal to anthracite.

Semi-bituminous Coal.—Compact, with laminæ of bright and dull coal alternately, fracture irregular, lustre moderate, cakes moderately, or is non-caking.

Bituminous Coal.—Much jointed, homogeneous, tender and friable, lustre pitch-like, glistening, often irridescent, colour black with a purple hue, powder brownish, cakes strongly, the best varieties forming a vitreous coke, with brilliant metallic lustre.

General Description.

Class I.—*The Hydrous Coals* of the South Island occur on the eastern coast chiefly.

Pitch Coal has been worked since 1867, at West Wanganui in Nelson; and in Otago at Shag Point, 40 miles north of Dunedin, it has been worked since 1862, together with brown coal. It is also found at Reefton, Nelson, where it contains resin disseminated throughout its mass; Waikato and Wangaroa, Auckland; Morely Creek, Southland. It belongs to the Upper Cretaceous period, and has an evaporative power of 5·2lbs.

Brown Coal is extensively worked in Auckland on the Waikato River, and in the Kaitangata mine, Clutha district of Otago, where the seams are from five to twenty feet thick. The area of this latter coal field is about 6,000 acres, and the quantity of coal has been estimated from surveys, to be 140 million tons, nearly the whole of which would be available without sinking. In the same Provincial District thick seams of brown coal in grits and clay shale have been worked since 1861 at Green Island and Saddle Hill, and extensive seams exist in Southland, and to the west of Riverton, which have not yet been regularly mined. It belongs to the age of the upper greensand, and has an average evaporative power of 4·2 to 5·6 lbs.

The Lignites occur in the interior of Otago, and at other places in superficial deposits of limited extent, and have been used chiefly by diggers.

Class II.—*The anhydrous* kinds of coal prove to be quite equal to any imported, experiments having been undertaken in 1865 for ascertaining their value as steam coals. Both these and the hydrous coals occur at the base of a great marine formation, underlying limestone, clays, and sandstone of cretaceous and tertiary age, which have a thickness of several thousand feet, the coal seams occuring whenever the above formation is in contact with the older rock. The anhydrous kinds are more limited in distribution, and appear to be produced by local disturbance of the strata, and in some cases are evidently due to the intrusion of volcanic rocks.

Bituminous Coal is worked chiefly in Nelson Province. At Mount Rochfort or Buller mines the seams are on a high plateau and are 10 to 40 feet thick, and from 900 to 3,000 feet above sea level; accurate surveys of this coal field show it to contain 140,000,000 tons of bituminous coal of the best quality and easily accessible; a railway 17 miles in length is now completed along the level country at the base of the ranges in which the coal occurs. At the Brunner coal mine on the Grey River, Nelson, the working face of the seam is 18 feet, and it has been proved to extend one-third of a mile on the strike without disturbance, and to be available for working in an area of 30 acres, the estimated amount of coal being 4,000,000 tons in this mine alone, most of which can be worked above the water level. Coal Pit Heath is a second mine lying more to the dip of the same seam. A third mine is being opened on the south side of the river, which, with a 370 feet shaft, will command 300,000 tons. The coal from the Brunner Mine, Nelson, which has now been worked for 12 years, yields vitreous coke, with brilliant metallic lustre. Average evaporative power of several samples, 7½lbs. of boiling water converted into steam for each pound of coal. It occurs with grits and conglomerates of Upper Mesozoic age, corresponding to the horizon of the Gault or Lower Greensand. A railway has been constructed by Government to connect the mine with the port, and harbour improvements are in progress, whereby a larger class of vessels than at present will be enabled to enter the river. The small quantity of this coal hitherto obtainable in New Zealand and Australian markets has been eagerly bought up for gas works and iron foundries, who generally pay for it from 10 to 20 per cent. more than for any other coal. Engineers of local steamers esteem it 20 per cent. better than the best New South Wales coal for steam purposes. Coke made from it is valued at £3 per ton.

Coal fields in other parts of the Nelson District have also yielded excellent coal. At Inangahua, Murray Creek, an 18-feet seam of semi-bituminous coal is worked, associated with quartz grits. At Pakawau, and in the same formation at Collingwood thin seams of hard bright bituminous coal have been worked from the sandstones of the cretaceous period. The area of the coal field is about 30 square miles, and the facilities of access and shipping, and the abundance of iron ore and limestone will probably make this an important mining district. The chief coal mine has been opened by a tunnel 700 feet in length, piercing the mountain at 600 feet above the flats along the Aorere River, the coal being brought down by a self-acting incline. This description of coal also occurs in the irregular seams in sandstone of Upper Mesozoic age (Jurassic and Lower Cretaceous), at Kawa Kawa, and Whangarei, Auckland; Mount Hamilton, and Waikava, Otago; it rarely cakes strongly, and has an evaporative power of commonly 6½ lbs.

Coal has been worked since 1865 in Auckland at the Kawa Kawa mine, Bay of Islands, from a seam 13 feet thick in greensand, it contains much sulphur. A similar quality of coal is also worked at Walton's mine,

and at Kamo mine, Whangarei Harbour, and several important mines are opened in the coal seams at the Malvern Hills, Canterbury.

Glance Coal.—This description of coal does not form a caking coke, but slightly adheres, and is a variety of brown coal, altered by faulting or by igneous rocks, and presenting every intermediate stage from brown coal to an anthracite. Occurring at Preservation Inlet and Malvern Hills, of Lower Cretaceous age, in extensive but detached seams from 2 to 6 feet thick in micaceous and argillaceous shales.

Coal Workings.

The first export of coal from New Zealand was made in 1866, amounting to 261 tons.

The following is a list of the principal Collieries, and the yield of each, for the year ending on 31st December, 1878 :—

Working Coal Mines in New Zealand for 1878.

Number.	Name of Colliery.	Number of Years Working.	Quality of Coal.	No. of Seams.	Thickness of Seams.	Output for Year in Tons.
	Auckland.				*Feet.*	
1	Kawa Kawa	14	Glance	1	6 to 15	40,000
2	Kamo	..	Brown	1	12	1,000
3	Whau Whau	14	do.	1	9	1,690
4	Taupiri	3	do.	2	6 to 14	11,137
5	Waikato	2	do.	1	18	3,073
6	Miranda	2	do.	1	55	2,000
	Nelson.					
7	Wallsend (Colliugwood) ..	11	Bituminous	..	1¼ to 32	50
8	West Wanganui	1	Pitch	2	1¼ & 3 to ¼	650
9	Westport	¾	Bituminous	1	4 × 6	1,190
10	Wellington	3	do.	1	18 × 24	1,468
11	Brunner	14	do.	1	12 to 16	19,404
12	Coal Pit Heath	2	do.	1	16	7,742
	Westland.					
13	Wallsend (Greymouth) ..	2	do.	1	16	6,882
	Canterbury.					
14	Springfield	2½	Brown	1	3¾ to 4½	3,001
15	Homebush	7	do.	3	3½ and 7	3,129
16	Canterbury	16	do.	2	2	830
17	Wallsend (Malvern) ..	2	do.	2	6 and 3	2,016
	Otago.					
18	St. Andrew's	10	do.	2	9 and 10	400
19	Prince Alfred	2	do,	2	9	2,400
20	Shag Point	16	do.	..	2 to 12	5,377
21	Fern Hill	⅔	do.	1	19½	132
22	Otago	5	do,	1	19	—
23	Freeman's	3	do.	1	16	4,560
24	Saddle Hill	4½	do.	1	19½	3,600
25	Green Island	6	do.	1	14	5,874
26	Walton Park	8	do.	1	18	17,106
27	Bruce	4½	Pitch	1	11 to 3	1,333
28	Real McKay	10½	do.	1	25	1,250
29	Shore's No. 1, Kaitangata	7	do.	1	30	924
30	Kaitangata C. M. Co. ..	3	do.	1	27	14,000
						162,218

The most notable feature in the development of the coal fields during the year was the great increase in the consumption of the Kawakawa coal; owing mainly to the circumstance that the Union Shipping Company have adopted it for their coastal steamers, and report most favourably of its utility as a steam coal.

The total quantity of coal imported during 1878 was, from—

New South Wales	172,254 tons
Other sources	1,894 ,,
	174,148

The total quantity of coal exported during the same year was, to—

New South Wales	400 tons
Victoria	3,513 ,,
South Sea Islands	8 ,,
	3,921

Of this quantity 3,913 tons was exported from Greymouth.

It thus appeared that the total consumption of coal in the colony during the year was 332,445 tons, of which 158,297 tons were derived from New Zealand mines.

It is not at all likely, however, that these figures will long continue to bear the same relative proportion, there being a fair prospect that the improvements now in progress for affording increased railway transport and better shipping facilities, will give such a stimulus to this valuable industry that the output will be sufficient, not only for the supply of a fair portion of the home consumption, but also for an increasing foreign trade.

GOLD AND SILVER.

Gold was discovered in 1842, less than three years from the foundation of the Colony, but it was not practically worked until 1852, when the mines at Coromandel first attracted attention to the district of Cape Colville peninsula, which at the present time forms the chief seat of true mining operations in New Zealand. The yield from those mines has up to the present time been over four and a half millions sterling, but is small when compared with the quantity of alluvial gold obtained in the South Island, subsequent to 1861, at which date the gold fields of Otago became prominently known.

Quartz Mining.

The principal Quartz mines in the North are in Coromandel and in the Thames districts, about 30 miles apart.

In these localities the reefs have been "proved" to a depth of over 600 feet below sea level; but the best mines have as yet been principally confined to the decomposed and comparatively superficial rock. Veins have been discovered, and gold obtained, at all levels on the ranges, from the sea level to an altitude of 2,000 feet. The quantity of gold that has been obtained from some of these quartz reefs is very great; and for considerable distances

the quartz has yielded very uniformly, at the rate of 600 ozs. to the ton, such reefs are, however, very exceptional in New Zealand, as elsewhere.

Auriferous reefs are also extensively worked in the schistoze rocks of Otago, and they occur at all altitudes, from sea level to a height of 7,400 feet, the most elevated gold mine in the Australasian colonies being that opened during the year 1878 on the summit of Advance Peak, near the Wakatipu Lake.

Several promising reefs have also been found in the Westland Gold Fields, amongst which may be mentioned a reef of auriferous *Stibnite* at Langdon's Creek, near Greymouth, which yields from a few ozs. to 99 ozs. of gold per ton; but up to the present time these reefs have not received the attention they deserve, except at Reefton and a few other localities. The importance of Reefton as a well established Mining district may be judged of from the fact that nine mining companies there, during the single year ending 31st March, 1878, divided, as profit, the sum of £63,508 among the shareholders.

So far as this more permanent form of gold mining is concerned there is every reason to feel confident that it is still in its infancy in this colony, and that it only awaits the judicious application of capital for its development to a vast extent.

Alluvial Mining.

Alluvial gold is chiefly found in the South Island, in the districts of Otago, Westland, and Nelson, in which mining operations are carried on over an area of almost 20,000 square miles.

The auriferous sand, or gold drift, as it is usually termed, is of three distinct kinds.

First, that which is found in the beds of rivers, and which is worked by small parties of miners, as the process requires no large expenditure of capital to effect the separation of the gold.

Secondly, immensely thick deposits of gravel of more ancient date occupy the wider valleys and the flat country, from which the gold can only be obtained by means of considerable expenditure and large engineering works for the purpose of bringing a supply of water for undermining and working the auriferous deposits. This description of mining is of a more permanent character than the former, and provision has been made by the Colonial Government for assisting the miners by the construction of water races, which will supply the means of profitable employment to a much larger number of persons than at present gain a livelihood by this description of mining.

Some of these deposits are of considerable age, the cements of Tuapeka being certainly not younger than the lowest tertiary deposits of the colony. They occur in beds from 300 feet to 500 feet thick, and cover a considerable area of country. These cements are treated in a different way to ordinary alluvial deposits, being crushed and washed in the same manner that a quartz reef is worked; but in consequence of the nature of the deposit about 150 tons of stone is thus put through the batteries in one day. They consist of coarse gravels and silts cemented together, and carrying variable quantities of gold, and were first found at the Blue Spur in Otago, and subsequently at a number of other places in the same district; at Charleston and elsewhere, on the West Coast, auriferous cements are also worked, but the localities first cited, however, are those which to the present time have received the greatest attention. The yield of gold from these cement claims is small, but in consequence of the large amount of material which can be operated upon,

the value of the deposits is considerable, and their extent guarantees that they will afford a remunerative return to those who are working them for some time to come.

Thirdly, along the sea coast, the continued wash of the waves produces a shifting action on the sands which are brought down by the rivers and drifted along the shore, thus producing fine deposits of gold, which, by the aid of simple mechanical contrivances, afford employment to a large number of diggers, who can labour without incurring the hardships and privations which attend the occupations of the miners in the more inland districts.

The alluvial diggings at Collingwood were discovered in 1858; those of Otago in 1861, and in 1864 the Gold Fields near Hokitika proved a great attraction to the mining population of New Zealand. In Otago the gold drifts rest on the denuded surface of their parent rocks. The auriferous gravels in the western district, on the other hand, as a general rule, rest on the surface of tertiary rocks of marine origin, and they have a general distribution parallel to whatever was the western shore of the island at the time of their deposit.

The richest alluvial diggings in Westland usually occur in places very inaccessible for water supply, the streams having cut their channels much below the surface of the country, so that an organised system of irrigation is necessary to obtain the required amount of water for the gold washing.

The following is the composition of the New Zealand gold as exported from various parts :—

Melted gold from West Coast, Hokitika, Westland:

			oz.	dwts.	grs.
Assay—Gold	·9627 = Fine Gold ..		9	14	16
Silver	·0363				
Copper	·0010				
Weight, 10 ozs. 2 dwt. 6 grs.					

Melted gold from Thames District, province of Auckland:

			oz.	dwts.	grs.
Assay—Gold	·6565 = Fine Gold ..		6	12	18
Silver	·3390 = Silver ..		3	8	13
Copper	·0045				
Weight, 10 ozs. 2 dwts. 6 grs.					

Refined gold, as extracted by Chlorine Refining Process, and as exported by the Bank of New Zealand, Auckland:

			oz.	dwts.	grs.
Assay—Gold	·9942 = Fine Gold ..		9	19	20
Silver	·0058				
Weight, 10 oz. 1 dwt.					

Total Exports.—The total quantity of gold entered for exportation from New Zealand up to the 31st December, 1879, amounted to 9,246,946 ounces, valued at £36,110,490.

SILVER AND SILVER ORES.

The silver exported from the colony has been chiefly extracted from the gold obtained at the Thames, which is alloyed with about 30 per cent. of the less valuable metal.

Within the last two years, however, several mines have been opened where the ore is argentiferous galena that yields 20 to 50 ozs. of silver to the ton. In some cases the galena is mixed with iron pyrites that yields a fair percentage of gold.

A mine has recently been opened in Nelson, at Richmond Hill, where the ore is a form of Tetrahedrite, a mixed ore, containing silver, antimony, zinc, bismuth, and copper, the silver being at the rate of from 20 oz. to 1792 oz. per ton.

The following is an analysis of the ore, which has been called Richmondite, after the locality in which it is found :—

Sulphide of lead	36·12
,, antimony	22·20
,, bismuth	traces.
,, copper	19·31
,, iron	13·59
,, zinc	5·87
,, silver	2·39
Oxide of manganese	·52

The total quantity of silver entered for exportation from New Zealand from the year 1869, when it was first exported, up to 31st December, 1879, amounted to 338,581 ounces, valued at £90,457.

IRON ORES.

No iron mines are at present worked, though almost every known variety of iron ore has been discovered in the colony ; the workings being limited to the black sands, which occur plentifully on the coasts. There are also few soils or stream gravels that will not yield a considerable quantity when washed ; the chief deposits are, however, on the sea shore of the west coast of both islands, the best known being that at Taranaki.

Several companies have been formed both in England and the colony to manufacture steel direct from this iron sand ; they have not, however, succeeded, but a partial success has been attained lately by a new company, by smelting, in furnaces, bricks formed of the ore with calcareous clay and carbonaceous matter ; it remains to be proved, however, if it can be treated in large quantities by this process.

Brown hematite Ore.

At Parapara, Nelson, immense quantities of brown hematite ore occurs on the surface of the ground ; some of this was converted into iron at Melbourne in 1873, and gave on analysis :—

Iron	97·668
Manganese	·268
Carbon combined	·542
,, free (graphite)	·208
Silicon, with titanium traces	1·004
Phosphorous	·041
Sulphur	·269
	100·000

Its principal characters are: colour uniform, approaching white; structure homogeneous, and finely granular, hard, brittle. This is therefore the variety called white iron.

A further very valuable deposit of brown hematite has been discovered by an officer of the Geological Survey Department, on the west side of Mount Peel, where the deposit is about 60 feet thick. This ore contains 56 per cent. of metallic iron, and has been traced for a distance of three miles, beyond which point it is reported by diggers to swell out to as much as a mile in width.

The following are the chief localities in which iron ore is found:

Specular Iron Ore.—Dun Mountain, Nelson. Occurs in irregular veins in greenstone rocks; contains 63 per cent. of metallic iron.

Specular Iron Ore.—Maori Point, Shotover, Otago. A six-foot vein in mica schist, equally rich with the above; extent unknown.

Compact Iron Ore.—D'Urville Island, Nelson. Vein, thickness unknown, in diorite slate, with serpentine and chrome; yields 63 per cent. of iron.

Magnetic Iron Ore.—This valuable ore, though occurring chiefly as black sands, is found in several parts of the colony.

Magnetic Iron Ore.—Dun Mountain, Nelson. In a vein 16 inches thick in serpentinous slates.

Magnetic Iron Ore.—Wakatipu Lake, Otago. In a vein in mica schists.

Magnetic Iron Ore.—Maramarua, Frith of Thames. From a vein in ferriferous slates; contains also oxides of titanium and manganese.

Black Iron Sand.—From beach at Taranaki.

Iron Band Ore.—Contains 70 per cent of iron. Occurs at Wyndham River, Otago, and Manukau, Auckland; formed by the black sand layers becoming cemented with hematite. This would be a most valuable ore if obtained in large quantities.

Brown hematite or hydrous oxide also occurs in *Assuri* in great quantity.

Reniform Iron Ore, Mongonui.

Bog Iron Ore, Spring swamps, Auckland, forms thick layers at the bottom of swamps. Though rich in iron the ore is inferior on account of the sulphur and phosphorus it usually contains.

Hematite, an analysis of this ore from Raglan, gave—

Sesquioxide of iron	72·69
Oxide of manganese	·31
Alumina	2·02
Magnesia	·69
Lime	·58
Phosphoric acid	not estimated
Sulphide of iron	·11
Hygroscopic water	4·61
Constitutional water	13·02
Silicates undecomposed by acids	5·97
	100·00

IRON SANDS.

The following tabular statement gives a particular account of Iron sands.

TABULAR STATEMENT OF IRON SANDS.

LOCALITY.	Matrix from whence probably derived.	Magnetite.	Hematite.	Titanite.	Per cent. of Iron	—
Upper Buller River, Nelson ..	Hornblende rocks	87·5	9·4	—	70·2	
Lower Buller River ,, ..	Tertiary gold drift of diorite slate ..	54·0	—	42·3	59·0	Auriferous.
Upper Molyneux River, Otago	Mica schist	82·7	—	9·7	65·9	,,
Lower Molyneux River ,,	Mica schist and tertiary strata ..	74·4	—	2·5	58·7	Auriferous and with 12 per cent. of glauconite.
Mountain stream, Canterbury	Palæozoic slates	62·7	37·2	—	66·2	
,, ,, Otago ..	,, ,, ...	86·1	10·5	—	58·5	Auriferous.
Tuapeka, Otago	Old gold drift	2·2	92·8	—	63·8	,,
Wakatipu, Otago	Mica schist	80·0	7·6	—	52·9	,,
Mataura River (Upper) ..	Diorite slate	9·8	—	70·9	41·2	
,, ,, ...	Old gold drift	63·5	16·1	8·0	60·6	
Stewart Island	Granitic rocks with greenstone dykes	77·8	—	20·1	57·3	Auriferous.
,, ,, ...	Hornblende rocks	71·5	20·0	8·2	70·1	,,
Anatoke, Nelson	Granite and hornblende	79·8	7·7	3·4	60·2	,,
Mahinepoa Lake (old channel of Hokitika).	River drift from diorite rocks ..	—	—	58·0	29·1	Auriferous, with garnets, topaz, disthene, &c.
Sea beach, Hokitika	Sea sand drift	75·0			54·0	Auriferous.
Motueka River, Nelson ..	Tertiary strata and granite ..	33·0	32·5		42·0	,,
Wairau River, Marlborough ..	Tertiary strata and granite schist ..	21·0	48·4		38·9	,,
Wanganui River, Nelson ..	Granite and tertiary	54·0	13·0		43·2	,,
Saddle Hill, Otago	Basaltic	58·3	—	25·6	52·9	
Green Island, Otago	Basaltic or sea beach	53·3	—	29·6	50·3	
Hooper Inlet	,, ,, ...	20·0	74·2		53·0	
West Bluff, Southland, Foveaux Straits.	Diorite or sea beach	12·2	—	40·6	28·6	Auriferous and platiniferous.
D'Urville Island, Nelson ..	Diabase and granite	78·6	—	—	57·4	Chrome iron.
Taranaki beach	Trachyte	91·9	—	6·2	70·1	
,, ,, ...	,, ...	71·0	—	8·0	56·1	Olivine and hornblende.
Tauranga beach	,, ...	87·4	8·6	—	68·0	

The composition of the chief massive ores of iron may be illustrated by the following analysis.

MASSIVE IRON ORES, OXIDES, AND TITANITES.

Variety.	Locality.	Centesimal Composition.					Percentage of Iron.	Remarks.
		Magnetite.	Hematite.	Titanic Iron.	Siliceous Matters.	Water.		
Impure magnetite.	Manukau, Auckland,.	60·20	37·90	Traces	1·90	—	70·06	
Magnetite ...	Dunstan Gorge, Otago	86·32	—	Traces	13·68	—	63·60	
Hematite ...	Dunstan, Otago ...	—	96·11	—	3·89	—	68·30	
Magnetite ...	Dun Mountain, Nelson	—	90·62	—	7·60	1·80	63·40	
Mixed magnetite and hematite.	Maramarua ,Auckland	2·24	87·10	Traces	10·66	—	62·30	
Bog iron ore ...	Spring Swamps, Auckland.	—	73·17	—	13·83	13·00	51·22	
Brown iron ore.,	Raglan	—	72·69	—	9·68	17·60	50·88	[oxide 1·38,
„ „	Kawau	—	67·98	—	19·65	12·37	47·58	Manganese
Hydrous hematite.	Parapara, Nelson ...	—	62·68	—	24·08	13·24	43·87	Contains a little manganese
„ „	Mount Peel, Nelson...	—	—	—	—	—	56·00	

BLACK BANDS OR SPATHIC IRON ORES.

Variety.	Locality.	Protoxide of Iron.	Sesquioxide of Iron.	Carbonic Acid.	Silicates.	Percentage of Iron.
Blackband ..	Collingwood, Nelson ..	35·23	25·77	21·12	3·93	46·06
Blackband ..	Collingwood, Nelson ..	40·38	5·26	21·97	16·69	35·12
Spathic ..	Nurunda, Collingwood ..	..	..	..	..	40·08
Spathic ..	Jenkins' Mine, Nelson ..	..	..	..	..	41·00

Spathic Iron Ore.—This occurs in considerable quantity in the Collingwood district, in most cases more or less oxidized; one form of this ore known as blackband is one of the most valuable kinds known, and alternates with the coal seams in Collingwood. A specimen of a siliceous and spathic iron ore from Otamataura gully is constituted approximately as follows :—

Carbonate of iron	56·9
Carb. lime and magnesia	2·8
Siliceous matters	40·3
	100·0

The iron amounts to about 27 per cent.

Other large deposits of spathic iron ore have been found at Footes' coal mine at the Miranda redoubt, and Jenkin's coal mine, Nelson. They contain 40 per cent., and 41 per cent. of iron respectively.

Analysis of Two Specimens.

	Spathic Iron Ores.	
	Malvern Hills.	Collingwood.
Protoxide of iron	51·2	35·23
Sesquioxide of iron	—	25·77
Oxide of magnesia	·8	1·00
Alumina	1·8	2·11
Magnesia	·4	1·94
Lime	·3	·71
Silica	13·6	·90
Sulphuric acid	—	Traces.
Carbonic acid	31·2	21·12
Phosphoric acid		not determined.
Sulphide of iron	—	·41
Water	·7	1·96
Organic matter	—	5·72
Silicates undecomposed by acids	—	3·03
	100·00	100·00

Hematite, containing about 40 per cent. of iron, occurs intermixed with quartz pebbles, in a stratum 100 feet thick exposed over several acres, at Parapara, Nelson, and from it an excellent paint is manufactured, which, being a pure peroxide of iron, is the best preservative for that metal. Wood coated with this paint is comparatively non-inflammable, and it is therefore much used in painting wooden buildings.

CHROME ORE.

This ore which is a mixture of chromic iron and alumina, is chiefly associated with magnesian rock, resembling olivine in composition, named *Dunite* by Dr. Hochstetter. It occurs in veins often 12 feet in thickness, and sometimes contains as much as 80 per cent. of chrome ore. This ore has been largely exported from Nelson, and is used for the manufacture of salts of chromic acid, possessing the properties of brilliant dyes. The pure ore contains 50 per cent. of the chrome oxide, and is worth £11 to £20 per ton, according to the state of the market.

COPPER ORE.

Copper mines have been worked in Auckland on Great Barrier Island, and in Kawau Island, and to a small extent in Doubtless Bay. It has been found associated with the metamorphic rocks in Otago and at Waipori, where a four foot sulphide of copper (pyrites) lode exists; an attempt to trace this lode was made for a short time and then abandoned.

A carbonate of copper is found in the same locality, but only in rolled fragments.

Copper has also been found in the form of cuprite and copper glance in the Dun Mountain, Nelson; and on D'Urville Island, at which latter place the ore has been traced to a depth of 100 feet; some of the better samples from this place yielding as much as 45 per cent. of copper.

A lode of copper pyrites mixed with pyrrhotine has also been discovered in Dusky Sound, Otago, and a mine is now being opened up at this place.

An interesting occurrence of native copper disseminated as fine grains through a granular serpentinous rock should also be noted. The extent of the ore is as yet unknown, but it occurs in the serpentine mineral belt of Nelson.

Cupreous iron ore in serpentine has been found at Dun mountain. It is interesting from its being slightly auriferous.

Copper pyrites is present in a lode three to five feet thick in mica schist, at Moke creek, Wakatipu Lake; it is associated with carbonate and native copper. The ore contains the high proportion of 11 to 55 per cent. of metallic copper, the usual average of Cornish ore being only five per cent. There is limestone in close vicinity to the lode, so that there would be no difficulty in reducing the ore to a "regulus," in which state it would save cost in shipment.

Near Collingwood, Nelson, a lode has been opened up, and contains 22 to 25 per cent. of metallic copper.

Grey Sulphide, found at Wangapeka, Nelson, contains 55 per cent. of copper, together with a little silver and gold.

In Kawau Island, Auckland, the lode first produced 16 per cent. of copper, and then fell off to 8 per cent, and at the bottom of the workings about 5 per cent. The width of the lode was 8 feet. The workings were discontinued chiefly on account of the high price of coal consequent on gold discoveries.

In Great Barrier Island the ore (pyrites) occurs in a quartz matrix; a fair sample of the mixed specimen afforded 26·62 per cent. of copper. The Otea Copper Mining Company worked this pyrites ore to a considerable extent.

LEAD ORES.

Lead occurs as galena in the province of Nelson, at Rangitoto mountain in Westland, and also at the Thames Gold Field.

It invariably contains silver to a considerable amount.

The following localities may be mentioned:—

Galena from Bedstead Gully, Collingwood.

Galena and zinc blende from Parapara Valley.

Argentiferous lead ore from Richmond Hill, Parapara, value 50*l*. per ton.

Galena, Wangapeka, Nelson. Sulphide of lead, with quartz that contains also sulphides of iron, and antimony with gold, in veins in felspathic schist; the galena contains 26 ozs. of silver per ton. The gold is only in those parts of the ore that contain iron pyrites.

Galena with zinc blende, Perseverance Mine, Collingwood, Nelson. Occurs in a band, 2 to 5 feet thick, parallel with auriferous quartz veins, those two ores are both pure, but so intermixed in the lode, that they could not be reduced separately.

ZINC ORES.

This ore occurs at the Perseverance Mine, Collingwood, Nelson, and in small quantity in Tararu Creek, Thames, where it is found in white cement with auriferous veins. It contains 60 per cent. of metallic zinc, which is worth about 15*l*. per ton.

It is also found in the following localities:—

Zinc blende and galena from Bedstead Gully, Collingwood.

Zinc as yellow or honey blende from Perseverance Mine, Collingwood, Nelson.

Zinc blende with galena and pyrites, the former having about 4ozs. of silver, and the latter 5 ozs. of gold per ton, Mount Rangitoto, Westland.

ANTIMONY ORES.

Stibnite lodes were discovered in 1873 near the coast of Queen Charlotte Sound, Marlborough, and proved to contain from 51·12 to 69·40 per cent. of antimony, the matrix being quartz. Similar lodes have been known for many years in the Shotover district, at Hindon, at Waipori, and other places in Otago.

A sulphide of antimony lode occurs some miles south of Collingwood, containing no less than ·757 per cent. of silver, which is equal to 185·88 troy ounces per ton.

Besides these localities antimony ores are found at Reefton, associated with gold; and also at Langdon's Reef, near Greymouth as already mentioned.

MANGANESE ORES.

These ores are useful for generation of chlorine for bleaching purposes, also for calico printing, &c.

The values of these common ores are from 3*l.* to 4*l.* per ton, and the following classes of them have been found.

Rhodonite (silicate of manganese), at Dunstan, Otago, as rolled masses; percentage of manganese about 40.

Wad (hydrous oxide), at Port Hardy, D'Urville's Island, Nelson; percentage of manganese about 45.

Braunite, or manganese oxide on Malvern Hills, Canterbury.

Ores are also found at Whangarei in Auckland, and in Napier; the latter contains 44 per cent. of manganese oxide, the remainder being mostly clay.

The same ore although of better quality is at present being successfully worked at the Bay of Islands. The shipments for the year 1879 amounted to 2,140 tons, valued at £8,338.

MINERAL OILS.

In 1866 attention was directed to the resources of the colony in respect to petroleum, and some very fine oils were found. There are three principal localities, and these produce each a distinct kind of oil:

1. The Sugar Loaves in the Taranaki Province.
2. Poverty Bay, on the east coast of the province of Auckland.
3. Mauntahi, Waiapu, East Cape.

The oil from the first has a very high specific gravity, ·960 to ·964 at 60° Faht., water at 1. It has thus too much carbon in its composition for its commercial success as an illuminating oil, but is capable of producing a valuable lubricating oil. It resembles oil occuring in Stanta Barbara County, California.

The second kind from Waiapu, Poverty Bay, is a true paraffin oil resembling the Canadian oil. By three successive distillations, and treatment with acids and alkalies, about 65 per cent. of a good illuminating oil is obtainable with specific gravity of ·843.

The third produces a pale brown oil, nearly or quite transparent, specific gravity ·829 at 60° Faht., burns well in a kerosene lamp for some time, and

is therefore of a very superior class, it contains only traces of paraffin, and produces 84 per cent. of an illuminating oil, fit for use in kerosene lamps, by means of a single distillation.

By two more distillations 66 per cent. of the crude oil has a specific gravity of ·811, which is that of common kerosene.

At Sugar-loaf Point, Taranaki, the Petroleum (rock oil) oozes from cracks in trachyte breccia. Wells have been bored to the depth of many hundred feet, but no steady supply of oil has been obtained. Crude oil has a specific gravity of ·962 at 60° Faht., and yields, by fractional distillation, oils having the following gravities :—

2	per cent. of oil of specific gravity	·874
10	,, ,,	·893
8	,, ,,	·917
60	,, ,,	·941
80	total distilled off.	
6·1	solid bitumen.	
12·4	fixed carbon.	
1·5	ash.	
100·0		

The following is an analysis of the Petroleum found at Waipawa River, Poverty Bay, Auckland :—

2	per cent. of oil, specific gravity	·809 (colourless).
16·0	,, ,,	·826 (nearly colourless).
16·0	,, ,,	·836 (pale yellow).
19·0	,, ,,	·850 (dark yellow).
11·0	,, ,,	·855 (brown, solid at 40° Faht.)
8·0	,, ,,	·864
21·25	paraffin oil.	
93·75	total distilled off.	
6·25	residue in retort, pitch.	
100·00		

At Waiapu, East Coast, Auckland Province, the crude oil has a specific gravity of ·872 at 58° Faht.; boiling point, 290° Faht.; flashing point, 230° Faht. A sample with a specific gravity of ·8294, gives—

40·0	per cent. of oil, specific gravity	·800 (colourless).
33·0	,, ,,	·826 pale-coloured oil).
12·5	,, ,,	·840
6·25	,, ,,	·860
4·25	,, ,,	·870
96·00	total distilled off.	
4·00	residue in retort.	
100·00		

Another analysis yielded—

11·20	per cent. specific gravity	·820 fine lamp oil.
37·75	,, ,,	·853 inferior lamp oil.
26·69	,, ,,	lubricating oil.
16·00	,, ,,	paraffin.
90·64	total distilled off.	
9·36	bituminous residue,	
100·00		

OIL SHALES.

Petroleum Oil Shales.—Pyroschist, or bituminous shales, occur to a small extent in the upper portion of the coal formation. Specimens have been examined from D'Urville's Island in Cook Strait, Mongonui, and Waiapu, in Auckland, Kaikorai, and Blueskin, in Otago.

A good variety of oil producing shale is obtained from the Chatham Islands, but it contains traces of sulphuretted hydrogen.

These shales have been distilled for oil, those from Mongonui and Chatham Islands producing the following excellent results.

Locality.	Centesimal Composition.					Relative percentage of Volatile Matter.	Relative percentage of fixed Carbon.
	Volatile Matters	Carbon.	Water.	Ash.	Sulphur		
D'Urville's Island ..	81·79	7·98	·69	9·54	Traces.	91·11	8·89
Mongonui	75·20	9·30	1·80	13·70	,,	88·99	11·01
Chatham Island ..	66·43	20·41	4·61	8·55	,,	76·49	23·51
Chatham Island ..	64·67	19·87	7·13	8·33	,,	76·49	23·51

GRAPHITE.

The mineralized substance known as graphite—plumbago—black lead, consists of carbon in mechanical admixture with siliceous matter, as clay, sand, or limestone, and in varying proportions, and is the ultimate product of vegetable remains, mineralized to the highest degree.

It has been found at Pakawau; in the vicinity of Wellington; and in the pure state embedded in marbles from the West Coast.

The pure amorphous variety is used for the manufacture of pencils, and for lubricants for machinery, while the impure siliceous or argillaceous graphites find extensive employment in the manufacture of crucibles, and for polishing material for ironwork.

Graphite of the first quality has not been found yet in any quantity in New Zealand, but there is an abundance of the impure varieties. It has been found in greater quantity in the province of Nelson than elsewhere, but still many other localities yield this mineral in various states of purity, as at Dunstan, Otago, which is of fair average quality.

A valuable sample of graphite has lately been reported from Waiokura Creek, Waimate, although the mineral has not yet been found *in situ*. The following are analyses of two samples:—

	1.	2.
Fixed carbon	86·9 ..	92·5
Volatile matter	6·6 ..	4·5
Ash	6·5 ..	3·0
	100·0	100·0

This specimen is of a very homogeneous character, and if, as is probable, purer bands should be found with it, the discovery will prove of great value. The colour of the ash is reddish white.

BUILDING STONES.

Abundant supplies of excellent stones for roads and building purposes are found in every part of the colony of New Zealand.

The varieties useful as such may be divided into—

1. Basalts and diorites.
2. Trachytes, granites, and crystalline schists.
3. Limestones (freestones in part).
4. Sandstones (freestones).

BASALTS.

Basalts, locally called "bluestones," occur of a quality useful for road metal, house blocks, and ordinary rubble masonry. They are found partly underlying and partly overlying the tertiary rocks, interstratified with tufaceous clays and local beds of altered volcanic ash. In the North Island these volcanic rocks are largely developed, and include some of very recent date.

True lavas and scorias are of frequent occurrence in the northern part of the islands. The latter have been quarried by the prisoners at Mount Eden, Auckland; their colour is dark grey, and though absorbent they are very hard and coherent.

In the South Island, on the other hand, the igneous rocks appear to be of much earlier date, and to have been nearly all of submarine origin. They are principally confined to the eastern sea-board, only rarely occurring at a greater distance than forty miles from the coast.

The Halswell quarries, Canterbury, produce an exceedingly hard and close-grained stone of a dull leaden grey colour; but its excessive hardness will necessarily limit its usefulness.

Diorites.—This stone occurs on the West Coast of Otago, at the Great Barrier Island, and many other localities where it can be quarried.

Aphanite occurs as a conglomorate at Dog Island and elsewhere as a breccia.

Porphyrites.—These stones are found at Flagstaff Hill, Water of Leith, and in the Malvern Hills.

Syenites occur at Dog Island, and the Bluff, and at various localities on the West Coast, and in Stewart Island; but the chief supply now available for industrial purposes is at the Bluff, and from the Boulder Bank at Nelson where a beautiful green variety occurs. It is hard, compact, and of a uniformly bluish grey tint of great beauty, consequently it is suitable for kerbing, paving, and massive masonry, as well as for monumental and architectural work.

In Isthmus Sound a vein occurs of a uniformly grey tint, but it is rather coarse.

TRACHYTES. GRANITES.

The group of trachytes contains many varieties both of composition and texture, but they all, together with the granites, are distinguished from the first group by containing a large proportion of silica.

At Port Chalmers a fine grey stone occurs. Another kind, a good freestone, is obtained at Harbour Cove, Otago, and Creightonville, Canterbury.

Granular trachytes are obtained from Governor's Bay, Lyttelton.

Trachyte porphyry is found at Tairoa Head, Moeraki, and Portobello; and from Port Chalmers a breccia is obtained, with which the graving dock there is entirely built. All the kerbing in Dunedin is from the quarries of this stone.

Sanadine trachyte is found at Portobello, Otago Harbour.

Phonolite or clinkstone of a columnar character occurs at Bell Hill, and a laminated and spheroidal variety at Blanket Bay.

The gaol and some other old buildings of Dunedin are built of a spheroidal clinkstone, which is of a mottled grey colour, and exceedingly hard and compact. The foundations of buildings in the city are frequently constructed with the same stone, which is eminently suited for the purpose. This stone is probably metamorphosed tufaceous sandstone.

Granite.—Granite is only found as mountain mass at Preservation and Chalky Inlets, on the western coast of the South Island, but exists in large veins and blocks in Stewart Island, and the whole of the west coast.

At the first-named localities the granite is of a pinkish tinge with grey spots, and rather coarse in the grain.

The veins and blocks supply a fine-grained, beautifully coloured stone, more suitable for architectural and monumental work than the former.

At Seal Island a fine grey granite vein occurs, having a smooth grain.

Granite rocks occur in detached areas in the Westland district, but not in accessible situations, being very different in that respect to those occurring on the south-west coast, where they admit of being quarried and shipped with great facility. At Astrolabe Island, and Tonga Harbour on the west shore of Blind Bay is probably the easiest place from which granite could be quarried. It is there of fine quality, and breaks out in masses that renders it suitable for kerbing and harbour works.

A variety with garnets is found at Metal Mountain, West Coast.

Crystalline schists.—Gneiss of equally good quality with the granite from the south-west coast is to be found in many other inlets, and on the north shore of Milford Sound there is one point where there is an immense accumulation of blocks of a grey variety mottled with crystals of garnet, and of all sizes and shapes, lying as if ready for shipment. Other localities are "Connecting Arm," and Anchor Harbour.

Limestones.

Marble—The purest form of this series is found in many localities in the South Island; statuary marble occurs among the gneiss and hornblende schists of the west coast, the grain of most samples hitherto found being rather coarse, but closer grained kinds exist in Caswell Sound, and also in the Mount Arthur district of Nelson,

Granular or crystalline and sub-crystalline limestones of every shade and colour, texture and hardness, occur plentifully, chiefly in the Middle Island.

Extensive masses of the harder compact kinds occur in the carboniferous formation. They are generally speaking of a blue colour and unfossiliferous.

One mass or stratum occurs in the slates of the Kakanui range; it is several hundred feet thick, with an outcrop of five miles in length, and is probably the best in the province of Otago.

A great variety of excellent building stones might be obtained from the Horse Range (Shag Valley side), at Twelve Mile Creek on Lake Wakatipu, Malvern Hills, Canterbury, and Hokanui Hills, Southland. In the latter province a very fine kind is obtainable, very slightly coloured; it belongs to the cretaceo-tertiary series.

A white granular limestone called the Oamaru stone is worked in extensive quarries in the Oamaru district; but it occupies a large tract of the country in the north part of Otago and throughout Canterbury, and has a remarkable uniformity of colour and texture; its weight, wet from the quarry, is 105 lbs. per cubic foot, and when perfectly dry, 92 lbs. A considerable quantity has been exported to Melbourne.

The principal buildings of Dunedin are built of this stone, which shows a very fair amount of durability.

At Wairoa, Auckland, there is a good hard close-grained stone, light buff colour, mottled with black grains.

Earthy Limestone.

Freestone.—A fine limestone of a brown tint occurs near Dunedin, at Boat Harbour; it works freely, seems durable, and is said to exist in large quantities, and to be procurable in moderately-sized blocks; it has the disadvantage of not being in an easily accessible situation.

A hard, shelly, and white limestone, belonging to a younger formation than the Oamaru stone occurs at Kakanui, and is used in some structures in that locality; it is of a uniform colour and consistency, and easily worked, and procurable in large blocks. The supply is unlimited.

Southland possesses a fair stone of this kind.

A valuable limestone occurs on the Otago Peninsula, near Port Chalmers, in two beds, one dark coloured and the other yellow, the last contains a rather large amount of fine grained sand, yellow and black; they burn to pretty good quick lime.

A good stone for lime occurs in the Isle of Scinde, Napier; it is fossiliferous and of upper tertiary age.

At Oamaru a compact variety of limestone is largely burnt for lime, but it is found in dislocated and concretionary masses intermixed with quantities of worthless rock, which greatly increases the expense of extraction. It is fossiliferous.

A hard very compact grey coloured stone of considerable purity occurs near the Moke Creek copper lodes, and would afford the flux required for reducing the ore. It is fossiliferous and of lower tertiary date.

Varieties.

Travertine limestone is found at Dunstan Gorge, Otago; it makes very white lime. It has the usual porosity of this kind of stone.

Geodic limestone.—This occurs at Hampden, Otago, and has numerous sparry cavities lined with crystallized calc spar.

Cellular limestone occurs at Nelson. This kind has numerous angular cells or holes.

A limestone breccia occurs at Ruatanua.

Lithographic limestone.—A lithographic limestone is found at Oamaru; it is a very fine grained stone, hard and compact, its fracture is conchoidal. It occurs in concretions in the limestone and not in slabs. The quarry is situated where the lower tertiary strata have undergone alterations by the extrusion of submarine igneous rocks, probably during their deposition. An extensive deposit of lithographic limestone also occurs at the Abbey Rocks, near the Paringa River, Westland, from which locality large slabs could be obtained. Lithographic limestone is also found in the Chatham Islands.

Chalk with black and white Flints is found at Kaikoura Peninsula, and the Northern part of Canterbury, a very pure bed of this material, which is of value for the manufacture of Cement, occurring near Oxford.

Sandstones.

Sandstones are very plentiful throughout the islands, and are very varied in hue.

The different kinds may be classed under the following heads :—

a. Siliceous sandstones, in which the cementing paste is a siliceous infiltration.

b. Calcareous sandstone, having carbonate of lime for its cohesive power.

c. Argillaceous sandstones, or claystones, in which clay replaces either of the above substances.

a. The true siliceous sandstones are found at the base of the tertiary and in the upper secondary formations, where they are associated with beds of coal.

The province of Otago has an extensive development of this kind of stone in the Horse Range, and south of the Molyneux River, and throughout the central districts of the Middle Island, capable of producing the most valuable kinds of building material. In Otago, Wakatipu Lake, Moeraki, Saddle Hill, Mount Pleasant, Waikawa, and Arden Bay; in Canterbury, Governor's Bay; and in Auckland, the Bay of Islands, produce stones of this class.

In the North Island, Mungaroa produces a good stone.

The Waikato district, and the range of mountains from Hawke Bay to East Cape, have large tracts where quarries of good stone might be worked.

b. Calcareous sandstones.—These are confined to the upper tertiary rocks, and are variable and concretionary.

In the South Island, the valley of the Wairau; and in the neighbourhood of Dunedin, Waikawa, and Oamaru, yield many varieties of compact hard stone suitable for building.

From Caversham, in the vicinity of Dunedin, a well-known, hard and compact stone is worked, bluish-grey or yellow in colour; its texture is remarkably uniform, but it is not durable. Other places in Otago are Pleasant River, Cornish Mount, Waikouaiti, Waikawa, Kaikorai Valley, Hawkesbury; and in Auckland at Motupipi.

In the North Island there are much more extensive districts where this stone occurs, the greater part of the province of Wellington, and also of Hawke Bay, being composed of tertiary strata in which this stone occurs.

c. Argillaceous sandstones or mudstones, claystones.—These, like the last kind, are found only in the upper tertiary beds, and are as variable; they occur at Saddle Back, Moeraki, Mount Pleasant, and at Anderson's Bay, Otago.

Cement.

Natural cement stones, or septaria, occur in the lower part of the Marine tertiary series, and in some cases are quite equal in quality to those which are burnt for the manufacture of hydraulic cement in Europe. The cement hitherto used so largely in New Zealand has been imported, but with the great resources that the colony possesses in the raw material for the manufacture, this will probably not be long continued.

In the following Table, Nos. 1 and 3 are analyses of the whole nodule, while Nos. 2 and 4 are without the calcareous veins. Those from Moeraki are very hard and compact, colour mottled grey, specific gravity 2·655, hygroscopic water 60 per cent. at time of analysis. Those from Amuri are similar in character. Septaria used in England and France for manufacture into Roman cement are added for the sake of comparison.

Obtained.	New Zealand.				England.	France.
	Moeraki.		Amuri.		Sheppey.	Boulogne.
	1	2	3	4		
Carb. of Lime.. ..	72·4	50·8	68·6	54·9	69·0	63·9
Carb. of Magnesia ..	·3	—	1·7	1·5	—	—
Alumina & Iron Oxides	8·7	7·6	6·5	6·4	10·5	12·3
Soluble Silica ..	·8	—	1·0	1·0	18·0	15·0
Sand and Clay ..	17·8	41·6	31·2	31·9		
Water	·6	—	1·1	1·2	1·3	·6

Materials for Portland Cement.

The manufacture of Portland cement might be made an important industry in New Zealand, excellent chalk and lime and non-ferruginous clay being obtainable.

The Italian pozzuolano might be imitated also, as there are extensive deposits of volcanic tufas occuring in the North and Middle Island. Those volcanic sands would require then to be ground up with an admixture of lime, and making, when correctly proportioned, an excellent hydraulic mortar.

Bricks.

The materials for brick making are plentiful throughout the colony. The clays are admirably adapted for the manufacture of the best kinds, and when it is properly weathered and tempered by mixing the clay into a perfectly homogenous mass, and thoroughly burnt, would equal any of British manufacture.

Pottery.

The success of the pottery works that have been established at Tokomairiro, also at Christchurch and other places, has proved the adaptability of the fire and pottery clays of the colony for the best kinds of fire bricks, drain pipes, chimney pots, tiles, and all kinds of pottery, porcelain, and terra cotta goods.

CLIMATE.

Meteorological Observations.

Meteorological observations have been made ever since the founding of the colony, though at first they were of an irregular character, and only with the view of comparing the climate of New Zealand with that of other countries. From 1853, Meteorological reports appear regularly appended to the Registrar-General's statistics; but it was not until 1859 that systematic observations were undertaken by a department established by Government. In that year eleven stations, equipped with carefully compared instruments, were established at Mongonui, Auckland, Napier, New Plymouth, and Wellington in the North Island; Nelson, Christchurch, Dunedin, and Invercargill, and some years later at Hokitika and Bealey in the South Island.

At a later date several new stations were established, making in all fifteen stations, from which monthly returns are sent to the head office in Wellington. From these the following returns are prepared for publication:—

I. A provisional return obtained by telegraph of the results at the chief towns, and which is appended to the monthly report of vital statistics.

II. An abstract of the results for each month compared in the averages for the same month in previous years is published in the Gazette and circulated in a separate form to all correspondents. These abstracts are intended for the guidance of agriculturists and other persons who require to watch the peculiarities of each season closely.

III. Tabular abstracts in the same form that has been followed since 1853, are prepared for the annual volume of statistics.

IV. A biennial report on the climate, embodying all the most interesting results, is published in 8vo. pamphlet and largely circulated.

In addition to the above, daily telegraphic reports of the weather are obtained at 9 a.m. from 25 stations, and are suspended for public information at all the shipping ports in the colony. Since 1874 this branch has been placed under the charge of a special signal officer, who issues warnings of the probable approach of storms to the different seaports.

The following tables embody the averages which have been ascertained for the different elements of the climate of New Zealand.

Temperature.

The climate resembles that of Great Britain, but is more equable, the extremes of daily temperature only varying throughout the year by an average of 20°, whilst London is 7° colder than the North, and 4° colder than the South Island of New Zealand. The mean annual temperature of the North Island is 57°, and of the South Island 52°, that of London and New York being 51°.

The mean annual temperature of the different seasons for the whole colony is, in spring 55°, in summer 63°, in autumn 57°, and in winter 48°.

COMPARATIVE TEMPERATURES OF NEW ZEALAND.

I.—General Abstract.

Station.	S. Lat.	Long. E. from Greenwich.	No. of Years of Observation.	Year.	Winter.	Spring.	Summer.	Autumn.	Difference of the coldest and warmest months	Yearly Means. Max.	Yearly Means. Min.	Yearly Fluctuation.
						North Island						
	° ′	° ′										
Mongonui ...	35 1	173 28	10	59·90	53·06	58 28	66·56	61·52	15·12	89·10	31·82	57·28
Auckland ...	36 50	174 51	20	59·54	52·34	57 56	66·92	61·16	16·02	88·52	33·26	55·26
Taranaki ...	39 4	174 5	14	57·56	50·90	55·94	64·58	58·82	15·66	86·90	30·02	56 88
Napier ...	39 29	176 55	10	57·56	49·10	57·74	66·20	57·02	19·26	90·00	32·10	59·90
Wellington ...	41 16	174 47	14	55·58	48·74	54·50	62·24	56·66	14·76	78·44	32 18	46 26
Wanganui ...	39 56	175 6	3	55·90	48·71	53·31	63·31	57·12	16·70	86·00	29·00	55·00
						South Island.						
Nelson ...	41 16	173 19	11	54·86	46·58	54·50	62·78	55·76	17·10	82·04	27·32	54·72
Hokitika ...	42 42	170 59	10	52·34	45·50	51·62	59·18	53·06	14·76	74·12	28·22	45·90
Bealey* ...	43 2	171 31	9	46·76	37·40	46·04	54·86	48·56	18·18	78·08	12·38	65·70
Christchurch	42 33	172 39	12	52·88	43·52	53·24	61·52	53·60	18·72	88·16	25·16	63·00
Dunedin† ...	45 52	170 31	17	50·72	43·52	50·54	57·20	51·80	15·30	84·74	29·84	54 90
Invercargill ...	46 17	168 20	14	50·36	42·26	51·26	58·10	50·00	16·92	83·84	20·12	63·72
Queenston‡ ...	45 2	165 39	3	51·01	40·01	50·92	64·02	52·31	21·25	84·60	23·21	61·39

* Height above sea, 2,104 feet. † Height above sea, 550 feet. ‡ Height above sea, 1,070 feet.

II.—Daily Range of Temperature.

Difference of the Mean Daily Extremes.

——	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Year.
Mongonui ...	15·48	16·74	15·30	19·08	18·18	16·92	15·30	15·66	16·92	16·02	14·58	16·74	16·38
Auckland ...	18·90	19·80	20·88	19·80	19·08	16·92	15·30	15·48	16·74	15·84	16·56	18·00	17·82
Taranaki ...	19·62	21·60	20·16	21·42	19·44	15·84	15·30	14·40	16·56	18·00	16·74	18·54	18·18
Napier	18·72	21·60	21·78	17·82	15·12	14·94	13·86	15·30	15·12	18·00	18·18	19 08	17·46
Wellington ...	13·32	13·50	12·42	12·42	11·70	11·16	10·62	10·62	11·52	11·88	12·24	13·50	12·06
Nelson	20·34	23·40	20·70	21·24	17·10	17·82	19·08	19·08	19·62	21·06	21·42	22·14	20·16
Hokitika ...	11·34	11·16	13·32	12·60	12·78	13·86	14·58	13·68	14·76	15·66	12·24	11·52	13·14
Christchurch ...	17·10	18·36	16·56	17·46	17·10	16·38	14·94	16·56	16·02	16·20	18·54	19·08	17·10
Dunedin	16·20	15·66	15·66	15·12	13·68	11·52	10·44	10·62	12·06	13·32	13·68	15·30	13·68
Invercargill ...	22·50	21·78	22·50	22·68	18·00	16·02	17·64	16·92	19·44	22·32	21·06	21·06	20·16

Comparison between climate on east and west coasts.

The climate on the west coast of both islands is more equable than on the east, the difference between the average summer and winter temperature being nearly 4° greater on the south-east portion of the North Island and 7° on that of the South Island than on the north-west, on which the equatorial winds impinge. This constant wind is the most important feature in the meteorology of New Zealand, and is rendered more striking by comparing the annual fluctuation of temperature on the opposite sea boards of the South Island, which have a greater range of temperature by 18° at Christchurch on the east than at Hokitika on the west.

Rainfall.

The observations that have been taken show that the northern part of New Zealand is within the influence of the sub-tropical winter rainfall. The probability of rainfall in winter in that part of the colony being twice as large as in summer.

In the south, however, the rainfall though irregular, is distributed more equally over the year. The chief difference to be observed, is that on the

west coast spring rains prevail and summer rains on the east coast; while in the middle of the colony the driest season is autumn, and in the south it is the winter and spring.

The contrast between the rainfalls on the east and west coasts, as with the temperature, is most striking. Thus, in the North Island, Napier on the east has only half the amount of rain that falls in Taranaki on the west. But the South Island with its longitudinal range of lofty mountains, exhibits this feature in a still more marked manner, for the rainfall on the west is nearly five times the amount on the east. The excess of precipitation on the coast is clearly illustrated by the distribution of the glaciers on the opposite sides of the range. Those on the west slope have an excessive supply of snow, and descend to a line where the mean annual temperature is 50° Falht., while on the east slope they descend only to the mean annual temperature of 37°. The winter snow line on the southern Alps, on the east side is 3,000 feet, and that on the west side is 3,700.

I.—Review of the Proportions of Rain in New Zealand.

Stations.	Rainfall.					Probability of Rain.					Mean Max. in 24 Hours.
	Winter.	Spring.	Summer.	Autumn.	Total for Year.	Winter.	Spring.	Summer.	Autumn.	Year.	
North Island.	Percentage.				Inches.						
Mongonui ..	36	24	23	17	58·132	0·66	0·50	0·33	0·39	0·47	3·500
Auckland ..	32	25	19	24	47·008	0·61	0·52	0·33	0·41	0·47	3·358
Taranaki ..	29	27	20	23	59·442	0·52	0·51	0·35	0·38	0·44	2·520
Napier ..	39	15	35	11	36·004	0·26	0·22	0·24	0·17	0·22	—
Wellington ..	29	24	24	22	51·542	0·51	0·43	0·37	0·40	0·43	2·610
South Island.											
Nelson ..	27	26	29	17	61·599	0·27	0·25	0·22	0·18	0·23	7·189
Hokitika ..	24	28	28	20	111·653	0·52	0·61	0·57	0·48	0·54	3·532
Bealey ..	22	28	31	18	105·340	0·53	0·61	0·56	0·47	0·54	3·512
Christchurch	31	21	25	23	25·536	0·36	0·33	0·28	0·24	0·30	1·622
Dunedin ..	23	23	28	26	31·682	0·51	0·55	0·58	0·54	0·54	2·079
Southland ..	26	23	26	26	49·732	0·47	0·47	0·40	0·49	0·46	1·130

II.—Totals of Monthly Rainfall in Inches.

—	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
Mongonui	2·339	3·209	7·787	1·492	2·882	5·461	8·319	6·598	6·241	5·831	3·701	4·272
Auckland	3·409	2·071	3·272	3·150	3·402	4·771	5·721	5·279	4·331	4·331	3·520	3·752
Taranaki	4·921	3·221	3·908	2·579	3·520	7·720	5·914	6·299	5·177	5·252	5·969	4·858
Napier	5·630	3·571	3·650	1·130	1·358	1·532	3·402	3·681	6·870	2·414	1 539	1·201
Wellington	3·999	3·882	4·453	3·780	3·280	4·540	5·212	5·658	4·299	3·941	5·000	3·500
Nelson	4·319	5·358	8·331	2·063	3·221	5·177	4·441	6·319	6·233	6·319	5·000	4·815
Hokitika	12·169	8·902	9·871	6·752	8·611	6 370	8·240	9·638	9·130	5·878	13·402	12·690
Bealey	14·087	9·681	8· (	3·921	7·433	8·079	5·019	10·378	7·799	5·811	15·501	8·733
Christchurch	1·622	2·311	2·370	1·752	1·811	2·280	3·189	2 449	2·319	1·161	2·142	2·130
Dunedin...	3·012	3·599	2 142	2·220	2·122	3·949	2·441	2·500	2·228	2·000	2·500	2·969
Southland	3·622	5·279	3·921	3·980	3·571	5·401	5·019	3·441	4·390	2·661	3·929	4·520

The fluctuation in the Annual Rainfall in the principal Stations is shown in the following Table ;—

RAINFALL.—1866 to 1876.

—	Mean Annual Rainfall.	Means for each year, and difference from General Average.									
		1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
North Island—												
Auckland	45·306	42·000 —3·306	53·180 +7·874	49·087 +3·781	52·797 +7·491	44·831 —·475	47·505 +2·199	42·096 —3·210	41·237 —4·069	35·024 —10·282	51·310 +6·004	44·025 —1·281
Taranaki	58 084	55·700 —2·384	60·690 +2·606	50·420 —7·664	55·125 —2·959	54·720 —3·364	72·120 +14·036	63·640 +5·656	53·120 —4·964	57·220 —·864	66·960 +8·876	48·180 —9·924
Napier	37·260	30·000 —7·260	..	..	..	32·850 —4·410	35·890 —1·370	23·940 —13·320	42·380 —5·120	37·940 +·680	38·260 +1·000	38·390 +1·130
Wellington	50·781	41·100 —9·681	41·950 —8·831	55·522 +4·741	56·768 +5·987	48·205 —2·576	64·057 +13·276	50·945 +·164	54·985 +4·204	53·496 +2·715	65·827 +16·046	43·374 —7·401
South Island—												
Hokitika	112·156	127·500 +15 344	110·510 —1·646	120·210 +8·054	88·210 —23·946	116·680 +4·524	122·440 +10·284	123·210 +11·054	96·170 —5·986	104·480 +7·676	130·790 +18·634	116·325 —14·465
Christchurch ..	25·774	19·400 —6·374	30·070 +4·296	30·041 +4·267	27·292 +1·518	28·364 +2·590	27·935 +2·161	19·741 —6 033	26·330 +·556	22·790 —2·984	32·310 +6·536	23·990 —1·029
Dunedin	32·019	29·000 —3·019	39·050 +7·031	33·893 +1·874	32·918 +·899	39·202 +7·283	22·146 —9·873	27·393 —4·626	35·825 +3·806	28·739 —3·280	42·631 +10·612	38·260 +5·586
Southland	43·674	47·200 +3·526	41·620 —2·054	46·346 +2·672	42·680 —·994	53·950 +10·276	39·030 —4·644	40·110 —3 564	37·480 —6·194	44·650 +·976	44·180 +·506	—

The distribution of the rainfall in different parts of the islands is best expressed by an approximate statement of the hydraulic discharge from the various drainage areas. The average rainfall, and the percentage allowed for evaporation and soil absorption, have been estimated for each area from such information as is available, but must only be accepted as provisional.

SCHEDULE of the PRINCIPAL RIVERS in NEW ZEALAND, showing approximately the AREAS OF WATERSHEDS, the AVERAGE ANNUAL RAINFALL, and DISCHARGE for each.

RIVER.	AREA in Square Miles.	Average Rainfall. Inches.	Estimated Discharge in Cubic Feet per Minute.	Remarks.
NORTH ISLAND:				
Waikato	4,768	40	839,168	
Kaipara	2,622	47	545,376	
Wanganui	2,525	47	525,200	
Manawatu*	2,239	65	642,593	
Thames	1,779	48	377,148	Including Piako.
Rangitaiki	1,633	30	215,556	Have a common embouchere in a coastal lagoon.
Whakatane	1,014	35	156,156	
Rangitikei	1,435	50	315,700	
Wairoa*	1,303	45	257,994	
Mohaka	1,034	45	204,732	
Ngararoro*	843	40	148,368	Might be concentrated on Napier Harbour.
Tutaekuri and Esk ..	487	35	73,998	
Tuhituki	815	35	125,510	
Mokau	815	60	215,445	
Patea	622	55	151,146	
Waipaoa, Poverty Bay* .	602	30	80,066	Partly combine in floods.
Gisborne	75	35	11,550	
Hokianga	560	50	123,760	
Waiapu*	505	40	88,880	
Waitaira	501	56	123,747	
SOUTH ISLAND:				
Clutha*	8,248	30	1,088,736	
Waitaki*	4,730	26	539,220	
Waiau (South)	3,079	41	557,299	
Mataura*	2,378	30	316,274	
Buller*	2,341	95	990,879	
Taieri*	2,317	37	379,988	
Grey*	1,572	90	624,084	
Wairau*	1,562	35	240,548	
Oreti	1,422	40	250,272	
Waimakariri*	1,922	55	345,546	
Rakaia*	1,401	50	308,220	
Rangitata*	752	48	159,424	
Selwyn (Lake Ellesmere)	718	30	94,776	
Jacobs	633	40	111,408	
Haast*	412	125	227,424	
Kaduka (Martin's Bay) ..	283	127	158,480	
Hokitika*	382	120	202,460	
Oamaru Creek	23	22	2,231	
Milford Lagoon and Opihi	888	28	109,224	

NOTE.—Rivers marked * have mountain sources not trapped by Lakes, and are therefore subject to exceptional floods.

Periods of lasting drought are almost unknown in New Zealand, and only in two instances do the records show a whole month at any station without rain. The greatest day's rain recorded is 6½ inches at Auckland, and 9½ inches in Nelson. Such heavy showers occur at the north-west stations, where the general average shows 70 inches in 85 days in the year. The opposite extreme is on the south-east, where 34 inches fell in 180 days.

Pressure of Air.

The mean atmospheric pressure in New Zealand between lat. 37° and 46° S. decreases from 29·981 to 29·804 inches; the average pressure being for all stations 29·919. For the corresponding north latitudes the average pressure is 30·005, but in the New Zealand area the fluctuations are much greater, and though frequent, are tolerably regular in their periods. The maximum pressure occurs in April, and the minimum in November. The extreme range of the barometer is a little over 2 inches, and the average daily range from hourly observations is ·043 inches.

The following are the observed averages of pressure for a few of the principal stations :—

I.—Monthly Range of Air Pressure.

—	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Year.
Auckland	0·657	0·681	0·728	0·756	0·909	0·961	1·043	1·051	0·965	0·886	0·827	0·835	1·417
Taranaki	0·740	0·883	0·886	0·984	1·028	0·917	1·094	1·138	1·024	1·051	0·929	0·752	1·594
Southland ...	1·193	1·122	0·854	1·039	1·079	1·240	1·256	1·248	1·197	1·094	1·240	1·169	1·732

II.—Daily Amplitude.

Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
0·038	0·034	0·038	0·044	0·050	0·046	0·041	0·048	0·044	0·050	0·042	0·042

Hourly Fluctuation of Atmospheric and Elastic Force of Vapour.

A.M.

—	Mid-night.	1	2	2	4	5	6	7	8	9	10	11
Bar. ..	+·013	−·001	−·003	−·012	−·010	+·004	−·006	−·006	−·005	−·003	−·001	−·011
El. Force	−·021	−·017	−·011	−·017	−·011	−·014	−·006	−·003	+·010	+·008	+·011	+·018

P.M.

—	Noon.	1	2	3	4	5	6	7	8	9	10	11
Bar. ..	−·012	−·012	−·016	−·010	−·008	−·003	+·007	+·019	+·025	+·021	+·020	+·019
El. Force	+·020	+·025	+·021	+·013	+·008	+·009	+·003	−·002	−·006	−·006	−·007	−·011

WINDS.

There is a marked prevalence of westerly winds throughout all seasons, and in all parts of New Zealand, but they are much modified by the form of the land. North-east or countertrades impinge on the north-east coast,

especially during the summer months, bringing rain; and cold south-easters, having heavy storms of rain and snow, occur during winter in the south, but only on rare occasions.

The westerly winds begin in the N.N.W., with heavy rain on the west coast, and gradually veer to S.W., when fair bright weather sets in on that coast; but the same southerly wind, sweeping along the east side of the islands, brings heavy strong weather locally known as "southerly bursters," and which, from the shape of the coast, reach the region of Cook Strait as S.E. storms; all the other winds are either land or sea draughts, with fine light weather, except on a few very rare occasions, while circular storms pass over the area from the N.W.

Thunderstorms.

Thunderstorms are most frequent in the districts where the changes of wind are most suddenly felt, from the moist equatorial currents to the cold polar currents of the S.W.

They are most frequent in spring on the west-coast, except in the extreme south-west of Otago, where during winter thunderstorms are of almost daily occurrence.

There being no westerly station on that part of the coast this does not appear in the following abstract:—

Average Frequency of Thunderstorms.

—	Mongonui.	Auckland.	Taranaki.	Hokitika.	Bealey.	Christchurch.	Dunedin.	Southland.
Winter ..	4·0	1·0	2·0	3·0	2·3	0·6	0·8	6·0
Spring ..	7·7	3·0	7·2	5·5	7·0	0·4	3·2	6·0
Summer ..	6·0	10·0	5·5	4·0	6·2	1·0	2·7	11·0
Autumn ..	0·5	4·0	2·0	2·0	1·8	1·0	0·5	6·5
Year ..	18·2	18·0	16·7	14·5	17·3	3·0	7·2	29·5

Black bulb and radiation Thermometer.

The difference in the amount of cloud in the atmosphere is best illustrated by a reference to the average readings of the black bulb and radiation thermometer, for which comparison certain observations from the stations on the opposite sea coasts of the Southern Alps have been tabulated; but the extreme readings of the black bulb thermometer, especially at the southern stations, are very remarkable, as they frequently reach to 175° Fah.

—	Christchurch, East Coast, 42° 38′ S.L.			Hokitika, West Coast, 42° 42 S.L.		
	Insolation.	Radiation.	Difference.	Insolation.	Radiation.	Difference.
Summer	131·72	44·78	86·94	84·02	48·38	35·64.
Autumn	111·92	37·94	73·98	73·04	41·72	31·32
Winter	91·22	28·04	63·18	61·70	33·44	28·26
Spring	124·52	34·34	90·18	75·02	39·56	35·46
Extremes	158·00	14·54	143·46	97·34	21·92	75·42

STATISTICS.

CENSUS RESULTS, 1878.

The colony of New Zealand was founded in 1839. Since that period eight censuses have been taken. While seven years elapsed between the first and second census, the succeeding enumerations were taken at intervals of about three years.

Population.

The following table exhibits the population, exclusive of the aborigines, when each census was taken :—

Date of Enumeration.	Population.			Centesimal Increase.	Number of Inhabited Houses.
	Persons.	Males.	Females.		
December, 1851 ..	26,707	15,035	11,672	—	—
24 December, 1858 ..	59,413	33,679	25,734	122·46	12,812
December, 1861 ..	99,021	61,062	37,959	39·99	22,398
December, 1864 ..	172,158	106,580	65,578	73·86	37,996
December, 1867 ..	218,668	131,929	86,739	27·01	54,015
February, 1871 ..	266,986	156,431	110,555	17·25	57,182
1 March, 1874 ..	341,860	194,349	147,511	16·82	61,356
3 March, 1878 ..	414,412	230,998	183,414	38·36	79,657
Increase from 1867 to 1878	..	..	..	89·52	—

In the above numbers the military and their families have not been included, as they did not constitute a portion of the settled population of the colony, and have now been all removed.

Nationalities.

The Nationalities composing the above population on 3rd March, 1878, were as follows :—

English and Welsh	108,195	
Scotch	47,949	
Irish	43,758	
Australian	16,091	
New Zealand born (white)	174,126	
Other British Possessions	4,840	
Foreign	18,505	
Uncertain	9,401	
		414,412

Proportion between the Sexes.

In March, 1878, there were 79·40 females to every 100 males, but in that proportion the Chinese people were included, and as they do not come to the colony with a view to permanent settlement, and do not bring their women with them, a juster estimate of the general population would be made by estimating the proportion exclusive of the Chinese. The proportion thus arrived at would be 100 males to 80·98 females.

Number of Chinese.

The number of Chinese included in the above amounted to 4,438, of whom nine were females.

Density of Population.

The population of the colony, exclusive of Maoris, amounted, in March, 1878, to 3·112 persons to a square mile; but as 151,160 persons resided in towns, the population outside the towns, numbering 263,252, only amounted to 2·5 persons to a square mile. The population was most dense in the Province of Canterbury, amounting there to 6·769 persons to a square mile, and least dense in the Province of Marlborough, where it only amounted to 1·778 persons to a square mile.

The average number of persons to an inhabited dwelling throughout the colony was 5·02 in 1878, against 4·88 in 1874, 4·48 in 1871, and 4·05 in 1867. But while the average number of persons to each dwelling was on the increase, the average character of the dwellings was evidently improving, and their capacity for occupation by a larger number of persons becoming greater.

The average number of persons of the suburban and rural population to a square mile in each of the provincial districts, and the proportion of the population in each district that resides in towns, are herewith given:—

	Average Number of Outside Population to the Square Mile.	Proportion of Town Population to Total Population of District.
Auckland	2·072	33·4
Taranaki	1·783	32·6
Wellington	1·985	57·5
Hawke Bay	2·031	37·7
Marlborough	1·136	36·1
Nelson	1·442	37·2
Westland	1·935	45·6
Canterbury	5·148	23·9
Otago	2·827	38·1

Number of and description of Dwellings.

The following table will show the increase or decrease in the number and description of the dwellings containing respectively one or two rooms, three or four rooms, and five or more rooms:—

—	Total Number of Inhabited Dwellings, including Tents.	Number of Inhabited Dwellings containing			
		One or two Rooms including Tents.	Three or four Rooms.	Five or more Rooms.	Number of Rooms not stated.
1878	82,588	24,034	29,223	27,616	1,715
1874	61,356	19,612	21,027	19,679	1,038
Increase	21,232	4,422	8,196	7,937	677
Decrease	—	—	—	—	—

In addition to the 82,588 inhabited dwellings, there were 5,296 unoccupied dwellings, and 497 dwelling houses that were being built. Of this total of 85,450 dwellings, 3,001 were built of brick or stone, 68,771 of wood and iron, 2,748 of sod, or similar material, 453 of raupo (viz., a framework thatched with raupo or bullrush), 2,202 were described as huts of sod clay, wood, or stone, and 2,931 were tents or dwellings with canvas roofs. The materials of 2,482 dwellings were not specified. In addition to the above dwellings, 4,401 buildings were returned as stores, warehouses, workshops, business premises, and buildings used for offices only.

Comparative Populations of Cities and Towns.

There were, in 1878, 95 defined cities or towns, having a population of 100 persons and upwards, classified as under :—

1	Upwards of	20,000
1	15,000 to	20,000
2	10,000 „	15,000
4	5,000 „	10,000
12	2,000 „	5,000
15	1,000 „	2,000
20	500 „	1,000
40	100 „	500

The following are some of the principal towns with their population in 1878. As the population of Dunedin, Christchurch and Auckland, cannot fairly be estimated without taking the suburbs in account, these have also been included.

Names and Population of principal Cities, including Suburbs.

Auckland and Suburbs	24,772	Greymouth	2,921
New Plymouth ..	2,680	Christchurch and Suburbs	26,653
Wellington	18,953	Dunedin and Suburbs..	35,026
Napier	5,415	Oamaru	4,927
Nelson	6,604	Timaru	3,389
Hokitika	3,202	Invercargill	3,761

Ages of the People.

Of the 414,412 persons enumerated on the 3rd March, 1878, 8,225 males, and 7,890 females were infants under the age of one year. There were, including these infants, 69,744 under five years of age, viz., 35,382 males and 34,362 females. The numbers at the ages usually recognised as the school ages, *i.e.*, five and under 15 years, amounted to 105,244, viz., 52,914 boys and 52,330 girls. The total number under 15 years of age was thus, 174,988, viz., 88,296 males and 86,692 females. There were 20,062 youths and 20,208 young women, or a total of 40,270 persons at the ages of 15 to 21. Thus, while during the first year of age there were 100 males to 96·65 females, there were 100 males under 21 years of age to 100·79 females at the same ages. The children under five years of age amounted to 16·77 of the population; the children of five and under 15 years amounted to 25·53 per cent. of the population; and the young persons of 15 and under 21 years of age amounted to 9·70 per cent. of the population; the total number of persons under 21 years of age amounting to 52·00 per cent. of the population. The total number of persons of 21 years and under 40 was 127,120, viz.,

75,759 males and 51,361 females. The persons of 40 years of age and under 65 numbered 64,928, viz., 42,417 males and 22,511 females. The number at 65 years of age and upwards amounted to 5,335, 3,103 being males and 2,232 females. There were 321 persons, viz., 167 males and 154 females between 80 and 90 years of age, 14 males and 11 females between 90 and 93 years age, and two males and eight females between 94 and 97 years of age, two males between 97 and 100, and two males between 104 and 105 years of age.

GENERAL SUMMARY OF AGES OF POPULATION.

TABLE showing the NUMBER of PERSONS, MALES and FEMALES, (exclusive of Maoris) living at three periods of ages.

	NUMBERS.		
	Persons.	Males.	Females
All ages	414,412	230,998	183,414
Specified ages	412,621	229,637	182,984
Up to 20 years	208,206	104,773	103,433
From 20 to 60 years	194,526	119,073	75,453
Over 60 years	8,098	4,430	3,668
Unspecified	1,791	1,361	430

The Chinese included in the above numbers amounted to 4,433 persons, viz., 4,424 males and nine females.

Religions.

Out of a population of 414,412, the persons who objected to state their religious belief amounted to 10,564. No entry was made in the column for "religion" in the household schedules opposite the names of 1,743 persons.

The following table gives a summary of the numbers of each religious denomination :—

Religious Denomination.	Persons.	Males.	Females.
Church of England and Protestants, not otherwise defined..	176,337	98,142	78,195
Presbyterians	95,103	52,567	42,536
Wesleyans and other Methodists ..	37,879	18,279	18,600
Baptists	9,159	4,706	4,453
Congregational Independents	5,555	2,846	2,709
Lutherans	5,643	3,663	1,980
Christians—Church of Christ	1,560	812	748
Unitarians	432	288	144
Society of Friends	183	141	42
Roman Catholics, and Catholics undefined	58,881	32,284	26,597
Greek Church	64	61	3
Jews	1,424	807	617
Pagans (Chinese)	4,379	4,374	5
Otherwise described	5,570	3,216	2,354
Undescribed	1,743	1,181	562
Objecting to state their religion . ..	10,564	6,631	3,933

The Protestants of all denominations amounted to 330,291 ; the Catholics, including the Greek Church, to 58,945, Of the Protestant denominations the members of the Church of England (including Protestants not otherwise defined) amounted to 176,337 or 42·55 per cent. of the

population. The Presbyterians numbered 95,103 or 22·95 per cent., and the Methodists numbered 37,879 or 9·40 per cent. of the population. The Roman Catholics numbered 58,881 or 14·21 per cent. of the population. Of the principal denominations, the proportions to the 100 of the population having been respectively in 1878 and 1874 as follows:—

	1878.	1874.
Church of England	42·55	42·46
Presbyterians	22·95	24·20
Roman Catholics	14·21	13·48
Methodists	9·40	8·42

Of the smaller bodies, the Baptists increased from 6,335 or 2·12 per cent. to 9,159 or 2·21 per cent., the Congregational Independents varied from 5,441 or 1·82 per cent. to 5,555 or 1·34 per cent., the Lutherans from 3,914 or 1·31 per cent. to 5,643 or 1·36 per cent., and Hebrews from 1,215 or ·40 per cent. to 1,424 or ·34 per cent.

Allegiance.

The number of British subjects in the colony in 1878 amounted to 395,607 or 95·52 per cent. of the population whose allegiance could be ascertained. In this number was included all persons born in British possessions, all naturalized British subjects, British subjects born in Foreign countries, persons having British names born at sea, and those whose birthplaces were not given, but who had British names. The foreign subjects amounted to 18,569 or 4·48 per cent.

Numbers born in New Zealand.

The persons in New Zealand in March 1878 who were born in the colony numbered 174,126; of these 87,787 were males and 86,339 were females. The total amounted to 42·02 per cent. of the whole population. The number of New Zealand born in 1874 was 122,635. There has thus been an increase of 51,491 or 41·99 per cent. on the New Zealand born population. The population as given does not include the Maoris or native aboriginal tribes.

Numbers born outside the Colony.

The Australian born were 16,091 in 1878, an increase in the three years of 2,490 or 15·50 per cent. The English born increased from 74,628 in 1874 to 108,195 in 1878 or 4·49 per cent. The Scotch increased from 38,431 to 47,949 or 24·77 per cent. The Irish increased from 30,255 to 43,758 or 44·32 per cent.; and the Germans increased from 2,819 to 4,649 or 79·52 per cent.

Conjugal condition of the People.

In 1878, out of every 100 of the male population (excepting Chinese) 28·06 were married, and 70·09 were single; and, of the female population, in every 100, 34·32 were married, and 62·59 were single, while the proportion of married males has increased from 27·28 per cent. in 1874 to 28·06 per cent. in 1878, the proportion of married females decreased from 37·59 per cent. in 1867 to 34·32 per cent. in 1878. The decrease in the proportion of married in the 100 females is attributable to the great increase in the number of females under 21 years of age. In 1867 the females under 21 years amounted to 54·87 per cent. of the whole number of females, in 1871 to 56·82 per cent., in 1874 to 57·96 per cent., and in 1878 to 55·38 per. cent.

158,388 males were returned in 1878 as unmarried, of these 104,651 were under 20 years of age, and 53,737 were over 20 years of age. Of the females 114,736 were unmarried, of whom 86,665 were under 15 years of age, and 28,071 over 15.

There were thus 25,666 bachelors of 20 years of age and upwards in excess of the number of spinsters of 15 years of age and upwards. To every 100 spinsters there were therefore 191 bachelors. Of the 28,071 spinsters, 15,510 were from 15 to 20 years of age, and 12,561 at 20 and upwards.

The husbands in 1878 numbered 63,424, the wives 62,909, the husbands being most numerous by 515. There was an excess of husbands over wives in every province except Wellington, where the wives were the most numerous by three in number.

The widows amounted to 5,672, being in excess of the widowers by 1,496, the latter only amounting to 4,176. The widows were more numerous than the widowers at all ages. Under 30 years of age the widows numbered 355, the widowers 159; from 30 to 50 years of age the widows numbered 2,243, the widowers 1,758; at the age of 50 and upwards the widows were 3,074, the widowers 2,259. Thus to every 100 widows under 30 years of age there were 44 widowers; at the ages 30 to 50 to every 100 widows there were 78 widowers; and at 50 years of age and upwards, to every 100 widows there were 73 widowers.

At the higher ages the married men (with wives living) were more numerous than the married women, but at the same ages the widows were more numerous than the widowers. At the ages 65 and upwards there were 2,114 married men to 1,129 married women, while at the same period, there were 1,237 widows to 861 widowers. The number of married women in the colony in 1878 between 15 and 45 years of age was 50,999.

Legitimate Births.

The number of legitimate births in 1877 was 16,505 or 32·39 births to every 100 married women at 15 to 45, or on an average one child was born to every married woman at that age period every 3·90 years. In England, the legitimate births in 1870 amounted to 748,050 or 28·76 births to every 100 married women at 15 to 45, or one birth to each such married woman in 3·48 years. The married women comprised in the age period 15 to 45 are generally younger than the married women of the same age period in England. Taking the whole number of married women in each country between the ages 15 to 45 as a basis of comparison, the following figures show the proportions per cent. at the respective ages in England and New Zealand:—

Proportion to the 100 married women at the ages 15 to 45.

Ages.	England.	New Zealand.
Under 20	1·33	2·45
,, 20 to 40	80·01	82·38
,, 40 to 45	18·66	15·17

Education of the People.

The information required to be given on the household schedule was, as to the measure of education, limited to reading and writing, reading only or not able to read. Only those Chinese who were able to read and write English were to be enumerated as able to read and write. Of the 4,433 Chinese in the colony, 90 males and the two females were returned as being able to read and write, and 9 males as being able to read only. Dealing with

the population, exclusive of Maoris and Chinese, except for the census years previous to 1867, when the number of Chinese were not separately shown, it appears that in 1878, 69·52 per cent. could read and write, 6·76 per cent. could read only, and 23·72 per cent. could not read.

Percentage of Population able to Read and Write.

Year	1861	68·67 per cent.
	1864	72·70 ,,
	1867	71·35 ,,
	1871	69·20 ,,
	1874	68·15 ,,
	1878	69·52 ,,

The rate having been lowest in 1874 is attributable to the fact that in the earlier periods the proportion of males 21 to 40 years of age was greater than in that year; and in 1874 the proportion of children under 10 years of age was greater than in the preceding years, the proportions in 1864 and 1874 respectively of persons of those ages having been in the whole population as follows:—

Comparison of Ten Years

Under 10 Years.		21 to 40 Years.	
1864	26·37 per cent.	1864	44·53 per cent.
1874	32·36 ,,	1874	32·51 ,,

The percentage of females who could read and write was at each of the census periods considerably less than the percentage of males who could read and write. In 1878, while 72·11 per cent. of the males could read and write, only 66·33 per cent. of the females could read and write. The percentage of females able to read and write was less at all quinquennial periods of age, except at the periods 5 to 10, 10 to 15, and 15 to 20 years, when it was slightly in excess of the similar percentage of the males.

School Attendance.

In 1878, 62,866 children attended Government schools; 14,611 attended private schools; 62,273 attended Sunday Schools, and 9,706 were receiving tuition at home. The total number of children at what is generally defined as the school going ages, 5 to 15, was 105,235, but the above numbers of those attending school, also include children under 5 years and over 15 who were attending school.

While the population at 5 to 15 years increased 45·91 per cent between 1874 and 1878, the numbers attending school during the same period increased 88·96 per cent.; and the proportion of children attending school to the total number of the children at the ages 5 to 15, increased from 66·78 per cent. to 68·42 per cent.

Deaf and Dumb.

Ninety-four persons were tabulated under this head, 54 males and 40 females. Of these, 52 were under 15 years of age.

Blind.

One hundred and six persons, viz., 56 males, and 50 females were returned as being blind. Of these, 16 were under 20 years of age, 19 between 20 and 40, 13 between 40 and 50, 14 between 50 and 60, and 44 over 60.

Industries and Manufactures.

NUMBER AND DESCRIPTION OF MANUFACTORIES, WORKS, &c., IN OPERATION IN NEW ZEALAND, MARCH, 1878.

Description of Manufactory, Work, &c.	Total Number of Establishments.	Hands Employed.	Approximate Value of Land and Buildings. £	Approximate Value of Machinery and Plant. £
BOOKS AND STATIONERY—Printing Establishments	77	1,268	101,000	112,528
MUSICAL INSTRUMENTS—Pianoforte Manufactories	1	7	...	...
MACHINES, TOOLS, IMPLEMENTS—Agricultural Implement Manufactories	8	208	13,050	9,710
Machine Manufactories	8	111	8,970	4,920
CARRIAGE AND HARNESS—Coach Building, Painting	49	433	41,477	13,955
Railway Carriage	1	10	...	...
SHIPS AND BOATS—Ship, Boat Builders	43	322	19,313	29,073
Block, Pump Manufactories	2	5	...	...
Patent Slips	5	42	11,200	37,200
HOUSES, BUILDINGS, &c.—Lime Works	34	68	5,755	1,429
FURNITURE—Furniture Makers	11	87	12,950	4,485
Chair and Washboard Makers	1	3	...	...
CHEMICALS—Chemical Works	3	25	3,150	1,700
Cleaning and Dyeing	2	8	...	...
TEXTILE FABRICS—Woollen Mills	3	78	7,500	18,000
DRESS—Boot Manufactories	18	747	29,185	8,140
Clothing Factories	2	120	...	...
Oilskin Manufactories	2	9	...	...
Stocking Weaving	1	4	...	...
FIBROUS MATERIALS—Rope, Twine Works	19	109	11,695	20,373
Sail Factory	1	3	...	...
ANIMAL FOOD—Meat Preserving (including boiling down)—see Animal Matters				
Bacon Curing Establishments	6	35	1,100	550
Fish Curing "	2	17	...	...
VEGETABLE FOOD—Biscuit Manufactories	6	52	4,170	4,075
Grain Mills	102	325	166,611	126,274
DRINKS AND STIMULANTS—Breweries	91	513	228,965	81,315
Aerated Water, Cordial Manufactories; Steam, Gas	7	52	14,050	8,835
Coffee, Spice Works	10	40	10,800	4,650
Malt Houses	25	100	40,350	5,465
Sauce, Pickle Manufactories	2	8	...	...
Colonial Wine do	4	9	9,075	1,700
ANIMAL MATTERS—Boiling Down and Meat Preserving	32	443	73,775	39,875
Bone Cutting Mills	8	21	3,350	3,400
Brush Manufactories	1	18	...	...
Glue	2	5	...	...
Portmanteau	1	3	...	...
Soap, Candle Works	13	70	12,285	9,700
Fellmongery, Tanning, Currying, Woolscouring	100	671	78,995	42,758
VEGETABLE MATTERS—Chaff Cutting	6	10	10,180	980
Saw Mills, Sash and Door Factories	204	4,114	407,418	354,055
Paper Mills	2	23	...	...
Flax Mills	31	262	...	...
COAL—Collieries	40	518	224,888	51,055
Gasworks	12	145	48,149	175,144
STONE, CLAY, EARTHENWARE—Brick, Tile, Pottery Manufactories	124	620	57,775	25,908
Stone Quarries	14	90	5,190	3,325
METALS—Mining (Manganese)	11	11	...	...
Iron Foundries	28	855	81,042	75,308
Spouting and Ridging Manufactories	1	13	...	...
	1166	12,710	1,754,694*	1,289,028*

* These amounts represent the total values, including the values of certain industries the particulars of which are left blank in the Table, not being published for sufficient reasons

Occupations of the People.

The accompanying two tables give the latest information, in a condensed form, on the subject of the various occupations of the population,

OCCUPATIONS.—I. MALES.

TABLE, SHOWING THE POPULATION AND OCCUPATIONS OF THE MALE SEX OF THE COLONY AND PROVINCIAL DISTRICTS OF NEW ZEALAND, AS PER CENSUS TAKEN 3RD MARCH, 1878.

Class.	Order.	Occupations (arranged in Fifteen Orders).	The Colony.	Auckland.	Taranaki.	Wellington.	Hawke Bay.	Marlborough.	Nelson.	Westland.	Canterbury.	Otago.	Chatham Islands.
		Total Male Population	230998	44,800	5,173	27,877	8,509	4,283	14,385	10,577	50,424	64,850	120
		Total of Specified Occupations	228856	44,465	5,124	27,559	8,404	4,257	14,229	10,509	49,959	64,232	118
PROFESSIONAL ...	I.	I. Persons engaged in the general or local government, or the defence or protection of the country	2,469	569	135	572	88	34	123	112	362	471	3
		II. Persons engaged in the learned professions, or in literature, art, science (with their immediate subordinates)	3,795	818	95	570	142	60	184	140	765	1,020	1
DOMESTIC ...	II	III. Persons engaged in the domestic offices or duties of wives, mothers, mistresses of families, children, relatives (not otherwise returned)	84,775	17,184	2,057	10,290	3,040	1,600	5,005	3,048	19,1	23,358	24
		IV. Persons engaged in entertaining and performing personal offices for man	4,614	933	97	676	221	82	287	298	901	1.115	4
COMMERCIAL ...	III.	V. Persons who buy and sell, keep or lend money, houses, or goods of various kinds	7,238	1,468	141	1,097	258	86	368	330	1,429	2,059	2
		VI. Persons engaged in the conveyance of men, animals, goods, and messages	10,384	2,297	137	1,288	484	237	584	347	2,149	2,853	8
AGRICULTURAL ...	IV.	VII. Persons possessing, working, or cultivating land; raising or dealing in animals; or following pursuits subsidiary thereto ...	47,356	8,962	1,404	5,100	1,986	1,063	2,486	537	12.582	13.171	65
INDUSTRIAL ...	V.	VIII. Persons engaged in working and dealing in art and mechanic productions in which matters of various kinds are employed in combination	15,376	3,090	289	2,530	606	234	62	434	3,518	4,043	3
		IX. Persons working and dealing in textile fabrics, dress, and in fibrous materials	5,380	1,185	85	648	163	74	273	200	1,125	1,626	1
		X. Persons working and dealing in food and drinks	5,724	1,131	98	692	202	82	321	311	1,332	1,555	
		XI. Persons working and dealing in animal and vegetable substances	4,144	1,440	49	447	240	182	218	117	484	966	1
		XII. Persons working and dealing in minerals	21,522	3,353	117	1,153	242	159	2,992	4,156	1,794	7,555	1
INDEFINITE and NON-PRODUCTIVE	VI.	XIII. Labourers and others (branch of labour undefined)	13,554	1,362	388	2,255	665	342	636	350	3,746	3,806	4
		XIV. Persons of property and rank (not returned under any office or occupation)		117	10	38	10	7	14	6	44	53	1
		XV. Persons supported by the community, and of no specified occupation	2,225	556	22	203	5	15	109	128	559	581	
		Occupation not stated	2,142	835	49	818	105	26	156	68	465	618	2

according to the last census; the first table giving the occupations of males, and the second table those of females.

OCCUPATIONS.—II. Females.

TABLE SHOWING THE POPULATION AND OCCUPATIONS OF THE FEMALE SEX OF THE COLONY AND PROVINCIAL DISTRICTS OF NEW ZEALAND, AS PER CENSUS TAKEN 3RD MARCH, 1878.

Class.	Order.	Occupations (arranged in Fifteen Orders).	The Colony.	Auckland.	Taranaki.	Wellington.	Hawke Bay.	Marlborough.	Nelson.	Westland.	Canterbury.	Otago.	Chatham Islands.
		Total Female Population	183,414	37,861	4,290	23,192	6,506	3,274	10,743	6,355	41,498	49,619	76
		Total of Specified Occupations	183,332	37,853	4,288	23,178	6,504	3,271	10,731	6,347	41,485	49,599	76
I.	I.	Persons engaged in the General or Local Government, or the defence or protection of the country	34	5	1	5	1	...	3	...	10	9	...
	II.	Persons engaged in the learned professions, or in literature, art, science (with their immediate subordinates)	1,974	488	40	334	73	26	105	58	430	420	...
II.	III.	Persons engaged in the domestic offices or duties of wives, mothers, mistresses of families, children, relatives (not otherwise returned)	161,221	33,465	3,919	20,376	5,700	2,934	9,521	5,556	36,128	43,551	71
	IV.	Persons engaged in entertaining and performing personal offices for man	13,140	2,282	232	1,699	566	248	748	463	3,402	3,495	5
III.	V.	Persons who buy and sell, keep or lend money, houses, or goods of various kinds	388	100	19	35	8	7	24	18	71	106	...
	VI.	Persons engaged in the conveyance of men, animals, goods, and messages	56	11	...	14	...	1	5	1	11	13	...
IV.	VII.	Persons possessing, working, or cultivating land; raising or dealing in animals; or following pursuits subsidiary thereto	604	118	22	84	20	9	25	...	154	172	...
V.	VIII.	Persons engaged in working and dealing in art and mechanic productions, in which matters of various kinds are employed in combination	155	49	5	29	3	1	4	2	29	33	...
	IX.	Persons working and dealing in textile fabrics, dress, and in fibrous materials	4,552	1,043	38	496	117	42	228	190	959	1,439	...
	X.	Persons working and dealing in food and drinks	186	51	3	17	4	2	4	14	44	47	...
	XI.	Persons working and dealing in animal and vegetable substances	18	15	...	1	...	...	...	...	2	...	...
	XII.	Persons working and dealing in minerals	5	3	...	...	...	...	...	...	...	2	...
VI.	XIII.	Labourers and others (branch of labour undefined) ...	77	8	..	23	1	...	3	1	18	23	...
	XIV.	Persons of property and rank (not returned under any office or occupation)	85	32	4	8	2	...	4	...	19	16	...
	XV.	Persons supported by the community, and of no specified occupation	837	183	5	57	9	1	57	44	208	273	...
		Occupation not stated	82	8	2	14	2	3	12	8	13	20	...

MAORI POPULATION.

The total number of Maoris, and of half castes living as Maoris, was in 1878 estimated at 42,814, the greater part being in the North Island, only a few living in the South and its adjacent Islands.

The number of the principal tribes is 19; of these the Ngatikahungunu is the strongest; the Ngapuhi rank next in point of numbers; the Waikatos are third; then the Ngatiporon and the Arawas. Of the Maoris in the colony, 24,363 were stated to be males, and 20,335 to be females. The sex of 772 was not given.

As much difference of opinion has existed as to whether the numerical decline of the Maori race has not been, at any rate in certain districts, arrested, it may be interesting to compare, so far as they are given, the ages of the Maoris with the ages of the settled and steadily increasing population of England. The numbers and sexes of some of the Maori tribes have been imperfectly given. It is therefore necessary to deal only with those tribes for which full information as to numbers, ages, and sexes is given. This was the case in respect of the numbers belonging to 13 of the principal tribes, amounting in the whole to 31,645, according to an account taken in the year 1874. Of these 6,079 were males under 15, and 5,225 females under 15. The males over 15 amounted to 11,209, and the females over 15 to 9,132. There was a total excess of males over females of 2,931, or to every 100 males there were 83·05 females. In England, in 1871, the males under 15 amounted to 37·15 per cent. of the whole male population; the Maori males, of the tribes given, under the age of 15, amounted to 35·16 per cent. of the whole male population of those tribes. The females of similar ages were respectively, in England 35·12 per cent. of the whole female population, and among the Maoris 36·39 per cent. If the numbers of the males and females under 15 be respectively compared, the following result is shown:—

Proportions per cent. to the whole Population.

Age.	England.	Maoris.
Males under 15	18·09	19·21
Females under 15	18·03	16·51

To draw any conclusion from these figures, it would be necessary to have more exact information as to the numbers of the Maoris living at the various higher age periods, but the information has only been given for the periods under and over 15.

The existence among the Maoris of a higher proportion of females under 15 (ultimately to become wives and mothers) to the total female population than obtains in England, the numbers under 15 to the total females being respectively 36·39 per cent. among the Maoris, and 35·13 per cent. in England, might at first sight lead to the belief that the decline in the numbers of the race had been arrested, and that even an increase might be expected.

It will, however, be manifest that if there are causes in operation which increase the mortality of the adult Maoris without increasing the mortality of the children, the actual proportion of children to the whole population would be thereby much greater, and an appearance of productiveness shown which did not really exist.

Do such causes exist? Does the fact of the partial adoption by the adult Maori of civilised habits and costume, and the continual reversion to the habits and costume of barbarism, with a system rendered more susceptible to external influences, especially those of a humid and changeable climate, tend to promote the spread of disease, notably of tubercular diseases, and consequent mortality? Does the spread of drinking habits tend to shorten the life of the adult Maori? These and other similar questions have an important bearing on the subject.

The examination of the numbers of some of the tribes, points rather to the conclusion that some such causes of mortality among the adults do exist. The Ngatikahungunu show 41·91 per cent. of the males, and 41·21 per cent. of the females as being under 15 years of age. The Rarawa show 40·58 per cent. of the males, and 48·30 per cent. of the females as being under 15.

It is hardly conceivable that the women of these tribes should have been so exceedingly prolific, and that, as in the case of the Rawa, nearly one half of the female population should have been under 15, unless a large number of adult women had died before reaching middle age, thereby increasing the proportion of younger females by reducing the proportion of the adults.

It may be noticed in connection with this subject that in 1871 the Maoris were estimated at 37,502, and in 1867 at 38,540, while in 1874 they were estimated at 45,470, and in 1878 at 42,819. The estimates formerly made were, however, from the then state of feeling in the Maori population, necessarily much more imperfect and unreliable than those recently made.

GENERAL STATISTICS.—PUBLIC INSTITUTIONS.

VITAL STATISTICS.

The estimated population of the colony on 30th June, 1879, amounted to 445,563. These figures do not include the aboriginal natives, who numbered about 42,819. If that number be added to the rest of the population, there would thus be given a total of 488,382 inhabitants at that date.

Birth Rate.

The children born alive and registered in 1878 amounted to 17,770, or at the rate of 41·96 per 1,000 of the population. The average birth-rate in England for the ten years 1868–77, was 35·7 per 1,000. As in the English population the females are more numerous than the males, while in New Zealand the males are largely in excess of the females, to compare the birth-rate in the colony with the birth-rate in England, the rate should rather be estimated on a total population of which the males do not exceed the females. Deducting from the population the surplus males, the birth-rate in New Zealand in 1878 would have been at the rate of 46·24 per 1,000 of equal males and females.

Illegitimate Births.

These births registered in 1877 numbered 351, or 2·1 per cent. of the births registered. This is far lower than the rates in England or Scotland, the rates in the former country being 5·2, and in the latter 8·6, in 1878.

Marriage Rate.

The marriages in 1878 numbered 3,375, the number of persons married being at the rate of 15·94 per 1,000 of the population. This is somewhat lower than the average rate in England for the decade 1868–77, which was 16·6

Death-rate.

The death-rate in 1878 amounted to 10·96 per 1,000 of the population. The death-rate in England for 1878 was 23·8, the average rate for the ten years ending 1877 being 21·9.

The following table shows the number and proportion of births, marriages, and deaths, for the last eleven years. An opportunity of comparing the rates in New Zealand with the rates of the Australian colonies is afforded by the diagrams at the end of this book :—

PROPORTION OF BIRTHS, MARRIAGES, AND DEATHS TO THE POPULATION.
Decennial Return.—BIRTHS, MARRIAGES, AND DEATHS.

Year.	Estimated Mean Population of New Zealand.	Numerical.			Proportion to every 1,000 of Population.		
		Births.	Marriages.*	Deaths.	Births.	Marriages.*	Deaths.
1868	222,825	9,391	2,085	2,662	42·14	9·35	11·94
1869	231,934	9,718	1,931	2,721	41·90	8·32	11·73
1870	242,824	10,277	1,851	2,703	42·32	7·62	11·13
1871	260,630	10,952	1,864	2,642	40·64	7·15	10·13
1872	273,273	10,795	1,873	3,194	39·50	6·85	11·68
1873	287,252	11,222	2,276	3,645	38 99	7·90	12·66
1874	320,687	12,844	2,828	4,161	40·05	8 81	12·97
1875	358,858	14,438	3,209	5,712	40·23	8·94	15·92
1876	387,465	16,168	3,196	4,904	41·73	8·25	12·66
1877	408,348	16,856	3,114	4,685	41·28	7·62	11·47
1878	423,465	17,770	3,375	4,642	41·96	7·97	10·96

* The number of persons married, and the number married in proportion to every 1,000 of the population, may be ascertained by doubling the numbers in these two columns

Of the deaths in 1878, 2,156, or 43·60 per cent., were of children under five years of age.

Sexes of Deceased Persons.

Of the deaths, 2,716 were of males, and 1,926 of females, which, upon the estimated mean number of each sex living in the year, gives a rate of mortality among the males of 11·30 per 1,000, and among the females of 10·30 per 1,000.

Causes of Death.

The following table gives the classification of diseases which have terminated fatally, with the percentage of each class and order of disease, to the total mortality in 1874, 1875, 1876, 1877, and 1878 :—

	1874.	1875.	1876.	1877.	1878.
Class I.—Zymotic Diseases.					
Order 1. Miasmatic diseases	26·92	26·84	23·43	21·62	18·13
,, 2. Enthetic ,, ...	·14	·28	·23	·34	·34
,, 3. Dietic ,, ...	1·85	2·05	2·18	2·54	2·23
,, 4. Parasitic ,, ...	·41	·87	·71	·60	·78
	29·32	30·04	26·55	25·10	21·48
Class II.—Constitutional Diseases.					
Order 1. Diathetic diseases	2·93	2·38	3·24	2·20	3·01
,, 2. Tubercular ,, ...	9·40	9·82	9·95	10·93	11·04
	12·33	12·20	13·19	13·13	14·05
Class III.—Local Diseases.					
Order 1. Nervous diseases	10·67	9·61	9·40	10·89	11·18
,, 2. Circulation, diseases of ..	4·71	4·83	5·26	5·44	5·96
,, 3. Respiratory organs, diseases of	12·28	12·87	9·99	10·26	10·81
,, 4. Digestive ,, ,, ..	6·37	6·21	7·04	6·72	7·70
,, 5. Urinary ,, ,, ..	·99	1·09	1·24	1·45	1·79
,, 6. Generative ,, ,, ..	·26	·12	·20	·26	·24
,, 7. Locomotive ,, ,, ..	·22	·12	·18	·26	·15
,, 8. Integumentary system ,, ..	·53	·25	·63	·43	·29
	36·03	35·10	33·94	35·71	38·15
Class IV.—Developmental Diseases.					
Order 1. Children, diseases of	4·80	4·76	6·73	5·70	5·49
,, 2. Adults ,, ...	1·47	1·21	1·33	1·45	1·90
,, 3. Old people ,, ...	1·32	1·32	1·49	1·52	2·48
,, 4. Nutrition ,, ...	5·58	6·16	5·63	5·61	5·41
	13·17	13·45	15·18	14·28	15·26
Class V.—Violence.					
Order 1. Accident or negligence ..	7·31	6·86	8·32	9·63	9·17
,, 2. Homicide	·07	·26	·25	·30	..
,, 3. Suicide	·48	·51	·86	·68	·11
,, 4. Execution	·02	·02	..	·04	·81
Violent deaths not classed ..	..	·18	..	..	..
	7·88	7·83	9·42	10·65	9·09
Causes of death not specified	1·27	1·38	1·71	1·13	·95

The above table shows a considerable decrease, in 1878, in the total number of deaths from zymotic diseases, but an increase in the number from constitutional, local, and developmental diseases.

HOSPITALS.

There were, in 1878, 28 hospitals in the colony, into which 3,300 males and 1,000 females were admitted as patients during the year. The total number relieved as out-door patients during the year was about 17,000; 305 males and 75 females died in the hospitals during the same period. There was provision in these hospitals for 788 males and 273 females, or a total of 1,061 beds. The aggregate number of cubic feet of space amounted to nearly 1,100,000, or an average of nearly 1,037 cubic feet to each bed.

LUNATIC ASYLUMS.

There are eight lunatic asylums in the colony, which contained, at the end of the year 1878, 636 males and 313 females, being an increase of 59 male and 25 female patients upon the number at the beginning of the year. Of the above 949 patients, 411 males and 211 females were supposed to be incurable; 250 males and 131 females were admitted; 143 males and 88 females were discharged, and 51 males and 17 females died during the year. The asylums in the aggregate afforded accommodation for 925 persons (600 males and 325 females), with an average of nearly 787 cubic feet of space for each patient.

The proportion of lunatics to the general population, exclusive of Maoris, on 3rd March, 1878, the day of the last census being taken, was ... 1 to 471

In England, December, 1877, it was	.. ..	1 ,,	362
Victoria	,, ,, ...	1 ,,	313
New South Wales	,, ,, ...	1 ,,	362
Tasmania	,, ,, ...	1 ,,	317

IMMIGRATION AND EMIGRATION.

Up to the end of the year 1870, the conduct of New Zealand immigration was entirely in the hands of the different Provincial Governments.

The Public Works and Immigration Act of 1870 provided a sum of £1,000,000, out of the loan then authorised, to be expended upon the introduction of immigrants throughout the colony.

The very liberal system under which immigration has been conducted, and which allowed residents in the colony to nominate suitable persons for free passages, has been modified for a time owing to the presence of a superabundance of labor, coupled with the fact that more than the average number of the most desirable class of immigrants—small farmers and others with means—were coming forward, and paying their own passages to the colony.

The immigrants who have arrived in New Zealand, taken as a whole, may be said to be of a superior class.

The total arrivals in New Zealand during 1878 amounted to 16,263 persons, of whom 10,671 were males and 5,592 were females. The number of immigrants brought to the colony at the public expense amounted to 6,618; the unassisted immigrants numbering 9,645, of whom 2,640 arrived direct from the United Kingdom, and 7,005 from the Australian colonies, including a few from other parts.

The following table shows the General Government expenditure on immigration to New Zealand during each year ending 31st December, from the passing of "The Immigration and Public Works Act, 1870," to 1878, inclusive :—

Year.	Amount Expended. £	Year.	Amount Expended. £
1871	17,081	1875	447,578
1872	37,911	1876	323,708
1873	142,646	1877	140,828
1874	426,233	1878	102,190

A further expenditure on immigration was incurred by the late Provincial Governments between 1871 and 1876, amounting to £74,409.

The following is a decennial return of immigration, 1869 to 1878, also for 1879.

IMMIGRATION AND EMIGRATION.—TABLE FOR ELEVEN YEARS.

Year.	IMMIGRATION.			EMIGRATION.			EXCESS OF IMMIGRATION OVER EMIGRATION.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
1869	6,302	2,601	8,903	4,001	1,261	5,262	2,301	1,340	3,641
1870	6,178	2,946	9,124	4,203	1,344	5,547	1,975	1,602	3,577
1871	7,526	2,557	10,083	4,041	1,256	5,297	3,485	1,301	4,786
1872	6,775	3,950	10,725	4,417	1,335	5,752	2,358	2,615	4,973
1873	7,871	5,701	13,572	3,507	1,254	4,761	4,364	4,447	8,811
1874	25,830	18,135	43,965	4,367	1,492	5,859	21,463	16,643	38,106
1875	19,558	12,179	31,737	4,727	1,740	6,467	14,831	10,439	25,270
1876	11,524	6,890	18,414	4,677	1,782	6,459	6,847	5,108	11,955
1877	8,104	1,883	12,987	4,696	1,915	6,611	3,408	2,968	6,376
1878	10,671	5,592	16,263	4,138	1,623	5,761	6,533	3,969	10,502
1879	15,186	8,771	23,957	3,852	1,382	5,234	11,334	7,389	18,723

Emigration.

Of the number of persons returned as having left the colony during 1878, amounting to 5,761, 838 went direct to the United Kingdom, 4,316 to the Australian colonies, and 607 to other places.

FINANCE.

Revenue.

The Customs revenue, in 1878, amounted to £1,344,941, against £1,224,906 in 1877, being an increase of £120,035, or 9·80 per cent. The following figures show the comparative amounts realized by this branch of the revenue during the years 1866 to 1878, inclusive :—

	£		£		
1866 ..	844,267	being an increase of	114,259	or	15·65 per cent.
1867 ..	843,997	,, a decrease of	270	,,	·03 ,,
1868 ..	788,829	,, ,, ,,	55,168	,,	6·53 ,,
1869 ..	823,511	,, an increase of	34,682	,,	4·39 ,,
1870 ..	765,930	,, a decrease of	57,581	,,	6·99 ,,
1871 ..	731,883	,, ,, ,,	34,047	,,	4·44 ,,
1872 ..	813,279	,, an increase of	81,396	,,	11·12 ,,
1873 ..	965,800	,, ,, ,,	152,521	,,	18·75 ,,
1874 ..	1,188,948	,, ,, ,,	223,148	,,	23·10 ,,
1875 ..	1,234,967	,, ,, ,,	46,019	,,	3·87 ,,
1876 ..	1,206,791	,, a decrease of	28,176	,,	2·28 ,,
1877 ..	1,224,906	,, an increase of	18,115	,,	1·50 ,,
1878 ..	1,344,941	,, ,, ,,	120,035	,,	9·80 ,,
1879 ..	1,237,259	,, a decrease of	107,682	,,	8·00 ,,

The total ordinary revenue for the colony in 1878 was as under :—

Ordinary Revenue, raised by taxation	£1,533,393
Territorial ,, not raised by taxation	2,634,496
Total revenue	£4,167,889

Expenditure.

The ordinary general expenditure, or expenditure chargeable on general revenue, for 1878, was £4,365,275. This does not include special expenditure out of loans.

Public Debt.

The total public debt of the colony on the 31st December, 1878, mounted to £20,930,111; the total annual charge upon which was

£1,178,185, part of this sum, namely, £116,176, being a payment to the sinking fund. The amount of the accrued sinking fund, at the same date, was £1,678,127.

The estimated mean population for the year 1878, was 423,465. This is inclusive of 4,442 Chinese, but exclusive of 42,819 Maoris. The latter contribute largely to the revenue through the Customs, and many of them are wealthy. For the present purpose, therefore, they may very properly be included in the general total, which thus amounted to 466,284. These data give a total debt of £44 17s, 9d. per head, and an annual charge of £2 10s. 6d. per head of population, but the amount of the accrued sinking fund, £1,678,127, in reality reduced the public debt to £19,251,984, and therefore the rate per head is proportionately lessened to £41 5s. 9d. per head. It has, however, been very justly remarked, that the pressure of a public debt on a community is not to be estimated by the simple process of counting heads, but that it is to be more correctly ascertained by inquiry into the earnings and condition of the population. Consideration must also be given to the fact, that a large proportion of the debt of New Zealand exists in the form of reproductive works, already, in some instances, returning a fair interest on the outlay.

ACCUMULATION.

Banks.

The total average liabilities of the banks within the colony during 1878 amounted to £10,031,009; the total assets to £15,393,630; the total paid up capital on 31st December, 1878, to £5,130,609; the total amount of last dividends, to £348,875; and the total amount of reserved profits, at the time of declaring such dividends, to £2,228,800.

Savings Banks.

The figures given below show the operations of the Post Office Savings Banks for the last three calendar years. The severe depression which existed throughout the Colony during 1879 appears to have had comparatively little effect upon this business. A greater amount of money was withdrawn during the year, but the total amount left standing at the credit of depositors on 31st December is very little less than in 1878, and is greater than in 1877.

	1877	1878	1879
Number of Post Office Savings Banks ..	138	147	165
Amount of Deposits	£684,294	£762,084	£812,399
,, Withdrawals	£667,023	£742,053	£876,180
,, at credit of Depositors	£767,375	£819,071	£787,006
Average amount at credit of each Depositor ..	£26 13s. 7d.	£25 9s. 9d.	£22 13s. 0d.

The average cost of each Post-office Savings Bank transaction, deposit or withdrawal, in the year 1879 was 5¾d.; the average for the whole period of the existence of the Post-office Savings Banks in the colony being 7d. The proportion of depositors to the population was 1 to 13 for 1878. The proportion in the United Kingdom, in 1877, was 1 to 19.

On the 31st December, 1878, the total amount standing at credit of depositors in the Post Office Savings Banks amounted to ... £819,071
At the credit of depositors of other Savings Banks £224,133

£1,043,204

This amount is equal to £2 11s. 7d. per head of the European population at the same date.

These figures are valuable, as giving an indication of the prosperity of the working classes; but there is a very large amount of savings constantly

being invested in Building Societies, and as constantly being withdrawn for the purchase or erection of dwellings, of which no official record exists.

In diagram VII., amongst the statistical diagrams, will be found an interesting representation of the fluctuations in the rate of savings in New Zealand, in comparison with the rates of the Australian colonies, during the years 1868–1877, and with the average rate in Europe for the year 1877.

TRADE, INDUSTRIES, PRODUCTIONS ETC.

IMPORTS AND EXPORTS.

The following table exhibits the rapid growth of the import and export trade of New Zealand, from the date of the colony being established to 1878, inclusive; also for the year 1879 :—

Period.	Imports.	Exports, the Produce of the Colony.
	£	£
1841-5, average for 4 years	139,000	33,000
1845-9 ,, 5 ,, ...	193,000	77,000
1853-5 ,, 3 ,, ...	766,000	330,000
1856-60 ,, 5 ,, ...	1,188,000	438,000
1861-5 ,, 5 ,, ...	5,352,000	2,718,000
1866-70 ,, 5 ,, ...	5,168,000	4,335,000
1871-5 ,, 5 ,, ...	6,367,000	5,276,000
1876-7 ,, 2 ,, ...	6,939,000	5,783,000
1878	8,755,663	6,015,525
1879	8,373,233	5,563,245

The great bound exhibited in the above table, as taking place in the quinquennial period 1861–5, was caused by the gold discoveries. The first considerable export of this metal occurred in 1861, the value being £752,657, increasing in the following year to £1,591,389; and the year subsequent, 1863, to £2,431,723. A more than corresponding large increase in the imports took place in the same period, due to the great influx of miners and immigrants from all parts of the world.

The total import and export trade of the colony for the year 1878, in proportion to population, stood thus :—

Imports—per head	£20	13	6¼
Exports ,, ...	14	4	1¼
Total ..	£34	17	7½

Diagrams V. and VI., in the statistical diagrams at the end, exhibit a comparison between the import and export trade of New Zealand, the Australian colonies, and the United Kingdom.

Trade with different Countries.

A comparison of the total value of imports in 1877 and 1878, according to the countries whence they were received, gives the following results :—

	£		
United Kingdom—Increase	1,217.626	or	27·1 per cent.
Australian Colonies ,, ...	125,400	,,	4·9 ,,
United States ,, ...	131,049	,,	48·0 ,,
Other countries ,, ...	308,160	,,	4·5 ,,

The considerable increase of imports from the United States, noted in the above comparison, was due to a large importation from that country into the Canterbury Province, of reaping machines.

The following is a return, in detail, of imports and exports from and to different countries during the years 1877, and 1878:—

Imports and Exports from and to Different Countries.

Return of the Value of the Imports and Exports of the Colony of New Zealand from and to each undermentioned Country, Colony, or Port, during the Years 1877, and 1878.

Country, Colony, or Port.	1877.		1878.	
	Imports therefrom.	Exports thereto.	Imports therefrom.	Exports thereto.
	£	£	£	£
United Kingdom	4,115,544	5,321,499	5,533,170	4,727,242
Australia:				
New South Wales ..	675,056	216,740	789,739	239,190
Victoria	1,433,865	*584,264	1,443,702	750,390
Queensland	3,188	11,938	1,345	11,044
South Australia ..	70,811	36,793	48,577	51,723
Western Australia ..	4,949	3,181	50	—
Tasmania	100,384	7,945	110,450	20,939
Mauritius	162,699	—	207,210	16,173
Africa, Cape Colony ..	—	—	—	23,723
India (British possessions) ..	35,976	336	131,136	9
China (British possessions) ..	56,015	39,863	165,453	21,434
Java and Singapore ..	5,802	—	10,125	6,960
Islands in the Pacific:				
Caroline Isles ..	—	—	—	345
Kermadec Isles ..	—	9	—	—
Sandwich Islands ..	472	1,371	47	1,422
Navigators ,, ..	1,242	6,092	3,790	8,002
Fiji ,, ..	15,001	12,145	13,789	13,511
Society ,, ..	—	6,343	876	2,579
New Caledonia ..	1,482	8,984	2,323	4,536
Malden Islands ..	—	—	—	562
Cook ,, ..	9,844	8,455	4,314	11,820
Friendly ,, ..	1,465	21,373	3,020	27,532
Suwarrow ,, ..	1,945	2,400	—	1,594
Rotumah ,, ..	605	1,202	1,837	922
Savage ,, ..	457	—	1,378	273
Solomon ,, ..	44	989	253	131
Macquarie ,, ..	382	—	—	—
Norfolk ,, ..	1,115	4,201	328	3,006
New Hebrides ..	391	380	—	22
Marshall Islands ..	—	289	1,199	42
Canada	205	—	719	—
Gilbert Islands ..	—	—	540	219
France	1,863	—	25,101	—
Germany	—	—	1,321	—
Holland	—	—	2,503	—
Spain	—	—	120	—
United States of America: ..				
On the Atlantic ..	220,235	24,293	373,046	40,784
On the Pacific ..	49,421	3,565	59,526	3,159
Peru	—	—	9,476	20,112
Chili	—	8	—	3,516
Guam	—	1,015	—	1,671
Southern Whale Fishery ..	2,960	1,799	9,200	1,112
Total ..	£6,973,418	£6,327,472	£8,755,667	£6,015,700

* This includes gold to the value of £361,260.

The following table shows the total quantity and value of the principal articles (the Produce of the Colony) exported in 1877 and 1878:—

Articles.	1877. Quantity.		1877. Value.	1878. Quantity.		1878. Value.
PASTORAL—			£			£
Wool	64,481,324	lbs.	3,658,938	59,270,256	lbs.	3,292,807
Tallow	92,505	cwt.	156,552	100,375	cwts.	178,502
Hides	20,382	number	18,486	10,203	number	9,571
Sheepskins ..	245,770	,,	27,361	184,123	,,	16,239
Leather	2,634½	cwt.	24,294	1,825¼	cwts.	18,344
MINERAL—						
Gold	366,955½	ozs.	1,476,312	311,437½	ozs.	1,244,190
Silver	33,893	,,	7,556	23,019	,,	5,755
Coal	2,658½	tons.	2,071	6,362	tons	5,139
AGRICUTURAL—						
Flour	960¼	tons.	14,315	4,031½	,,	48,441
Bran and Sharps ..	2,444½	,,	12,583	1,079¼	,,	5,760
Wheat	859,795	bushels	204,157	1,701,011	bushels	423,032
Barley	107,675	,,	23,848	102,476	,,	24,468
Malt	1,746	,,	671	5,951	,,	2,137
Oats	354,694	,,	47,776	302,776	,,	59,130
Oatmeal	365	tons	6,956	510	tons	11,084
Potatoes	4,183¼	,,	14,205	9,370¼	,,	36,906
Butter	5,206¼	cwt.	23,458	3,106¼	cwts.	12,111
Cheese	4,999	,,	16,713	3,019	,,	9,368
Bacon and Hams ..	3,286¾	,,	11,380	3,786	,,	13,232
Salt Beef and Pork	2,751½	,,	4,258	2,794	,,	4,429
Preserved Meats ..	18,193¼	,,	53,401	28,187	,,	74,225
MISCELLANEOUS—						
Kauri Gum ..	3,632½	tons.	118,348	3,445¼	tons	132,975
Phormium (N.Z.Hemp)	1,053⅓	,,	18,826	622½	,,	10,666
Cordage	384½	cwt.	806	368½	cwts.	903
Timber (sawn & hewn)	8,222,329	feet.	37,675	4,071,326	feet	33,656
,, (logs) ..	2,097	number	13,171	847	number	5,168
,, (spars) ..	10	,,	55	70	,,	250
Sealskins	1,503	,,	1,652	820	,,	1,245
Whale Oil (sperm) ..	15,047	gallons.	4,032	17,483	gallons	4,841

MINERAL EXPORTS from 1853 to 1878, inclusive.

Year.	Coal. Amount.	Coal. Value.	Copper.* Amount.	Copper.* Value.	Iron. Amount.	Iron. Value.	Chrome Ore. Amount.	Chrome Ore. Value.	Silver. Amount.	Silver. Value.	Gold. Amount.	Gold. Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Oz.	£	Oz.	£
1853	41	114	170	1,750	18	254	—	—	—	—	—	—
1854	—	—	302	3,450	9½	137	—	—	—	—	—	—
1855	94	266	140½	3,800	1½	20	—	—	—	—	—	—
1856	—	—	514	11,418	65½	520	—	—	—	—	—	—
1857	3	9	1½	70	—	—	—	—	—	—	10,297	39,904
1858	2	4	351¼	5,000	—	—	3	25	—	—	13,533	52,443
1859	—	—	245	2,605	—	—	8	120	—	—	7,336	28,427
1860	1	2	137	1,590	—	—	116	1,440	—	—	4,538	17,585
1861	—	—	110	1,300	—	—	52	520	—	—	194,234	752,657
1862	—	—	51	1,024	—	—	3,483	24,719	—	—	410,862	1,591,389
1863	—	—	—	—	—	—	595	4,318	—	—	628,646	2,432,479
1864	—	—	—	—	105	52	768	4,910	—	—	479,914	1,855,830
1865	—	—	—	—	—	—	—	—	—	—	574,574	2,252,689
1666	261	400	—	—	—	—	281	1,315	—	—	735,376	2,897,412
1867	973	1,228	246	2,700	—	—	—	—	—	—	686,753	2,724,276
1868	1,027	1,210	84	977	7	80	—	—	—	—	637,474	2,492,793
1869	756	800	7	179	1	3	—	—	11,063	2,993	614,281	2,362,995
1870	1,672	1,508	7	120	—	—	—	—	37,123	11,380	544,857	2,163,910
1871	1,695	1,612	—	—	—	—	—	—	80,272	23,145	730,023	2,788,368
1872	990	855	—	—	—	—	—	—	37,064	9,910	445,370	1,730,992
1873	724	655	—	—	—	—	—	—	36,187	9,850	505,337	1,987,125
1874	1,463	1,363	—	—	—	—	—	—	40,566	10,380	376,388	1,505,331
1875	3,385	3,129	—	—	—	—	—	—	29,085	7,560	355,322	1,407,769
1876	1,854	1,954	—	—	—	—	—	—	12,683	3,171	318,367	1,268,599
1877	2,658	2,071	—	—	—	—	—	—	33,893	7,556	366,955	1,476,312
1878	6,362	5,139	4	234	—	—	—	—	23,019	5,755	311,440	1,244,192

* Approximate return for period prior to 1853, 2,400 tons, £70,000.

DECENNIAL TABLE.—Value of Principal Articles of Export.

Year.	Wool.	Gold.	Produce.	Tallow.	Kauri Gum.	Timber.
	£	£	£	£	£	£
1869	1,371,230	2,341,592	142,647	13,935	111,307	22,338
1870	1,703,944	2,163,910	184,513	75,583	175,074	18,509
1871	1,606,144	2,788,368	206,333	67,208	167,958	21,079
1872	2,537,919	1,730,992	371,887	68,788	154,167	26,718
1873	2,702,471	1,987,425	328,875	67,118	85,116	44,039
1874	2,834,695	1,505,331	432,924	65,366	79,986	44,450
1875	3,398,155	1,407,770	262,942	55,865	138,523	40,046
1876	3,395,816	1,268,599	399,374	109,896	109,234	49,847
1877	3,658,938	1,476,312	433,741	156,552	118,348	50,901
1878	3,292,807*	1,244,192	528,109	178,502	132,975	39,074

* Apparent decrease of production is due to the increased manufacture of woollen goods in the colony, and decreased price of wool in the European markets.

The value of the wool exported during the year 1879 was £3,126,439; of gold, £1,134,641; of agricultural produce, £763,635; of tallow, £145,595; of Kauri gum, £147,535; and of timber, £35,502.

SHIPPING.

The configuration of the colony, and the difficulties of traversing a country with few roads, early caused a considerable coastal traffic to be developed.

In December, 1878, there were 541 vessels on the New Zealand register, having an aggregate tonnage of 46,965 tons.

For the year 1878 the total shipping inwards was .. 456,490 tons
" " " outwards was .. 428,493 "

Regular and frequent steam traffic exists between all the principal ports of the North and South Islands, as also, between the colony and the Australian ports of Melbourne and Sydney. The ever increasing requirements of inter-provincial and inter-colonial traffic have been fully met, chiefly through the exertions and energetic enterprise of a local establishment, the Union Steam Shipping Company of New Zealand. Almost daily communication is now maintained between the large centres of population in the South Island and the Capital; and by means of new and very powerful steamers belonging to the Company the passage between Wellington and Lyttelton, the connecting link, so to speak, between the railway systems of the two islands, is practically reduced to a matter of some twelve or thirteen hours. This is a less time, by about four hours, than would be occupied by proceeding overland, supposing the present Canterbury line of railway continued to Picton, and a quick ferry established across Cook Strait between that port and Wellington.

There is also monthly communication with San Francisco by a subsidized line of mail steamers; the subsidy paid by the New Zealand Government in 1878 amounting to £32,500.

MANUFACTORIES, WORKS, &c.

Unstimulated by the questionable aid to be derived from so-called protective duties, the manufactories and industrial works of New Zealand yet exhibit unmistakeable progress; their total number in 1878, as shown in

detail in the census returns on a previous page, being 942, and in 1874, 657; an increase of nearly a third. This increase is composed almost wholly of an extension in the number of industries dependent on the natural resources of the country, or incidental to a rapidly increasing population, and would seem to indicate a hardy and natural growth. Thus fellmongery, tanning, and currying establishments increased from 71 to 100; boiling-down and meat-preserving works, from 10 to 32; saw mills, from 162 to 204; brick, tile, and pottery works, from 84 to 124; iron foundries, from 22 to 29; carriage works, from 19 to 49; and ship and boat building yards, from 20 to 43. The increase in the number of woollen mills from 2 in 1874 to 3 in 1878, is small, but the increased quantity of goods manufactured is really much larger than the small increase in the number of establishments would appear to indicate, and from occupying an almost experimental position the woollen manufactures have grown into a sure and flourishing industry.

The number of manufactories devoted to articles of clothing increased from 7 in 1874 to 23 in 1878.

CROWN LANDS.

Prior to the abolition of Provincial Government, the control and management of the crown lands in each province, was vested in the respective Provincial Governments, and the laws and regulations relating thereto were very various. In 1877, a general land act applicable to the whole colony was passed, entitled "The Land Act, 1877." Under this Act the supreme administration of all crown lands was vested in the Minister of Lands; the colony being divided into ten land districts, each having a Crown Lands Commissioner, one or more Receivers of Land Revenue, and a Board of Commissioners. Land not sold by auction, may, by special proclamation of the Governor, remain open for selection, at the upset price, on a system of deferred payments, extending over a period of ten years. Although the Act applies generally to the whole colony, the Commissioners have authority to modify some of its provisions so as to meet certain exceptional cases, as for example in the Canterbury district, where the price of rural land has invariably been £2 per acre, that price is named as the minimum price for that district. Again in some places where the land is of exceptionally poor quality, the Commissioners have power to proportionately lower the minimum price.

"The Land Act, 1877, Amendment Act, 1879," which came into operation on 1st January, 1880, contains some important provisions, not the least being the repealment of "The Crown Lands' Sale Act, 1877." It may be useful to give here a brief description of the leading clauses of the new Act affecting the disposal of crown lands.

Clauses 4-6 give power to the Governor to declare residence optional on bush land taken up on deferred payments; also to fix the price at which any allotments of rural or suburban land, open for sale on deferred payment, may be disposed of, the price, however, being not less, in any case, than

Twenty shillings per acre for Rural land, and
Ninety shillings ,, Suburban land,

and may increase the price of any allotments which he may consider to be of special value.

Clause 6 provides that several small sections, contiguous to one another, may be grouped into one allotment.

Clauses 17-19 contain provisions whereby two or more selectors of land on deferred payment may hold an allotment as tenants in common.

The following important clauses of the Act, relating to Village and Special Settlements, are given in full.

VILLAGE SETTLEMENTS.

20. The Governor, by proclamation in the *Gazette*, may from time to time set apart out of any Crown lands, such blocks or allotments of land contiguous to any line of railway or main lines of road, as he shall think fit, and declare the same open for sale as Village settlements; and he may from time to time alter, amend, or revoke any such Proclamation.

21. The Governor in Council may fix the terms and conditions upon which the lands comprised in any Village settlement shall be disposed of, and the mode of payment for the same, subject to the rules following:

(1.) Every village settlement shall be surveyed, and divided into village allotments not exceeding one acre each, and small farm allotments not exceeding fifty acres each; or, if the Governor so direct, a village settlement may be divided into village allotments only, or into small farm allotments only.

(2.) The Governor may fix a day on which any allotments within a village settlement shall be open for application, and may appoint that any such allotments shall be sold for cash immediately on purchase, or on deferred payments subject to the conditions of the said Act ["Land Act, 1877."]

(3.) The price of village allotments shall be not less than Five pounds per allotment, and of small farm allotments not less than One pound per acre: Provided, that in the case of inland districts not opened up by railway communication, it shall be lawful to the Governor to proclaim a district a special district for the opening of blocks of land as village settlements, and from time to time to alter, amend, or revoke such proclamation; and, in the case of village settlements included within the boundaries of any such special district, the price of village allotments shall be not less than Two pounds Ten shillings per allotment, and of small farm allotments not less than Ten shillings per acre.

(4.) All applications for land in village settlements shall be made in the same manner as other applications for land are directed to be made under the said Act.

(5.) If more persons than one apply for the same allotment on the same day, the right to occupy the allotment shall be determined by lot amongst the applicants in respect of small farm allotments; but, in respect to village allotments, the same shall be disposed of by public auction amongst the applicants at an upset price of not less than Five pounds for each allotment.

22. The Governor may grant a lease of any allotment within a Village settlement for any term not exceeding ten years, subject to such rent and conditions as he shall think fit, and may grant in any such lease a condition that the lessee may, at any time during the currency of such lease, purchase the land in such lease, at a sum to be stated in such lease, not being less than Thirty shillings per acre in any case.

23. Notwithstanding anything contained in "The Public Reserves Sale Act, 1878," it shall be lawful for the Governor to set apart, out of the lands described in the First Schedule of the Act named, any area or areas not exceeding in the whole five thousand acres, and dispose of the same as village settlements under the foregoing provisions of this Act.

SPECIAL SETTLEMENTS.

24. The Governor, by Proclamation in the *Gazette*, may from time to time set apart, out of any rural lands, such blocks of land as he shall think fit, and declare the same open for special settlement; and he may from time to time alter, amend, or revoke any such Proclamation: Provided that the total amount of land set apart as special settlements, in the colony, shall not exceed one hundred thousand acres in one year.

25. The Governor in Council may fix the terms and conditions upon which the lands in any special settlement shall be disposed of, and the mode of payment for the same, but subject in every case to the following rules, that is to say:—

(1.) Land in a special settlement shall be sold at a price to be fixed by competent valuation, not being less than One pound per acre.

(2.) Not less than one-tenth of the price of the whole block of land, selected for a special settlement, shall be paid by the person or persons selecting the same within three months after the deposit of the survey plan of the external boundaries of the block with the Chief Surveyor of the district wherein the block is situate.

(3.) Occupation and permanent improvement of the land to a certain proportion of its area, to be defined by regulations, shall be a condition necessary to be performed before the issue of a Crown grant for any such land.

(4.) Neither the whole nor any part of any block of land, set aside as a special settlement, shall continue so set aside for a period of more than five years from the date of the Proclamation whereby the same shall be set aside; but every contract made with respect to any such block or any part thereof, whilst the same remains so set aside, shall be performed notwithstanding that the block has ceased to be so set aside.

(5.) All lands within any special settlement block which, at the expiration of five years from the same being set aside, shall not be taken up on the conditions of such settlement, may be declared by the Governor in Council to be open to all purchasers as ordinary Crown lands, from and after a day to be fixed in such order.

Crown Lands Sold during year ending June 30, 1879.

The total area of Crown lands sold during the year ending June 30, 1879, was as under:—

	Acres.		Purchases.	Cash received.	Scrip.
Town Lands ..	404	to	1,138		
Suburban ,, ..	2,585	,,	191	£745,827	£19,864
Rural ,, ..	386,673	,,	3,243		

Total Land Sold or otherwise disposed of.

The total area of Crown land sold, or otherwise disposed of, from the first return in 1856 to 30th June, 1879, amounted to 14,014,632 acres, of which total 11,672,651 acres were sold for cash, realizing the sum of £11,210,412.

Remaining on hand.

The following tabular statement shows the area of Crown land remaining on hand on 30th June, 1879. This does not include land for the acquisition of which the Government is negotiating with the natives, or the large area

of land in permanent possession of the natives; neither does it include the large reserves made for various public purposes:—

Locality.	Open for Selection, 30th June, 1879.	Remaining at disposal of Land Boards, exclusive of Native Lands.	Total.
North Island.	Acres.	Acres.	Acres.
Auckland	15,417	2,370,744	
Hawke Bay	33,800	284,883	
Taranaki	5,139	1,337,623	
Wellington	22,244	1,125,977	
	76,600	5,119,227	5,195,827
South Island.			
Nelson	5,847,004		
Marlborough	1,096,593	1,056,547	
Canterbury	4,458,653	840,000	
Westland	246,145	2,657,709	
Otago	206,978	10,928,915	
Southland	1,551,701	218,487	
	13,407,074	15,701,649	29,108,723

The total number of acres of Crown lands held for depasturing purposes, June 30, 1879, was 12,253,876 acres, in the hands of 918 holders, the rents and assessments of which amounted to £111,000.

LAND TRANSFER.

The Land Transfer Act, modelled upon the famous system introduced by Sir Robert Torrens in South Australia, has now been in operation in New Zealand for some years, and the simple and inexpensive means which it offers for dealing with landed property and mortgages have been freely and extensively taken advantage of, as is indicated by the figures in the following returns:—

Return by the Registrar-General of Land for the Year ending 30th June, 1879.

——	Number.	Value.
		£
Applications for Registration	1,167	992,260
Transfers	8,027	2,644,485
Crown Grants— Acres.		
Town and Suburban 4,424 ..	3,134	
Country .. .. 489,603 ..		
Mortgages	5,094	3,948,546

The fees paid to the Government on the above-mentioned transactions amounted to £19,805, being £16,810 for general fees and £2,995 for land assurance, equivalent to an average of £1 2s. 9d. on each transaction.

Titles Guaranteed.

The sum mentioned of £2,995 for land assurance represents a charge of one half-penny in the pound on the value of land brought under the operation of the Act, in consideration of which the Government guarantees the titles. No claim, however, has yet arisen upon the assurance fund thus formed.

Mortgages.

The following return shows the mortgage transactions under the Land Transfer Act for the year ending 30th June, 1879 :—

District.	Total Amount secured by Mortgage under the Land Transfer Acts, during year ending 30th June, 1879.	Total amount of Mortgage paid off during same period.	Total amount remaining secured by Mortgage under the Land Transfer Acts, 30th June, 1879.
	£	£	£
Auckland	200,712	85,328	496,760
Otago	591,258	186,516	2,036,770
Canterbury ..	1,866,652	627,691	4,386,411
Wellington ..	506,459	164,940	1,121,628
Nelson	65,854	39,459	188,258
Southland	442,243	188,107	352,564
Hawke Bay ..	184,482	22,756	853,383
Westland	20,865	4,781	51,813
Taranaki	47,112	12,061	84,216
Marlborough ..	22,905	10,787	79,281
Totals.. ..	£3,948,546	£1,342,478	£9,651,089
Year 1877-78 ..	£3,329,579	£1,224,495	..

PUBLIC WORKS.

Any account of New Zealand's progress that failed to make special mention of the extraordinary changes wrought by what is commonly known as the "Immigration and Public Works" policy, would indeed be incomplete.

The rugged character of the country generally, and the natural difficulties appertaining to many of the sites upon which the chief towns were built, very early necessitated a large outlay on roads and public works. This necessity was fully recognized, and, to some extent met, by most of the Provincial Governments, who have justly received great credit for their far-seeing and liberal exertions in that direction. A great deal of road-making, often of a very costly character, was accomplished ; harbour, and other improvements begun, and immigration handsomely encouraged. Something was also done in the way of the making of railways, notably in Canterbury, where a line, unusually difficult and expensive in construction, involving some heavy tunnelling, was successfully undertaken and carried through by the Provincial Government, in order to provide easy means of communication between Christchurch and the Port of Lyttelton. Some advance towards the construction of a main trunk line had also been made in the same Province. In Otago, also, the City of Dunedin had been connected with Port Chalmers by a railway, constructed under the guarantee of the Otago

Provincial Government, and some miles of railway had been made in Southland. But the work to be done in the Colony generally was too vast to be grappled by the un-united exertions of a few local governments. It was therefore proposed that the General Government should take in hand the execution of all public works of a colonial character, upon an extensive and well-defined system, and that a loan of ten millions be raised to provide funds for that purpose. The objects sought to be accomplished were defined to be:—

I. Systematic Immigration on a large scale.
II. Construction of a Main Trunk Railway throughout each Island.
III. Construction of Roads through the interior of the North Island.
IV. The purchase of Native Land in the North Island.
V. The Supply of Water on Gold Fields.
VI. The extension of Telegraph Works.

In accordance with the plan thus laid down, The Immigration and Public Works Act, 1870, was passed by the Legislature, and many, who were greatly alarmed when the scheme was first propounded to the country by Mr. (now, Sir Julius) Vogel, and thought it wild and extravagant, have since admitted that the step taken was as wise as it was bold. A considerable extent of country has been opened up and settled by a large and thriving population in a surprisingly short space of time. As facilities were offered for the conveyance of the products of agriculture, the value of land, of course, greatly increased, not its nominal value merely, but its actual value. Hundreds of thousands of acres, worth, before the advent of railways, from £1 to £3 an acre, were afterwards sold at prices ranging from £10 to £20 per acre, and, for the most part, bought by experienced farmers, who had made their money in the colony, and knew the real capability and value of the land so purchased. It may, also, be said, that in addition to the enormous reproductive indirect results of the Public Works Policy, the outlay incurred, at least in the case of the railways constructed, is likely to prove a capital investment, and so be directly reproductive, many of the principal lines already yielding a fair interest on the money expended in their construction.

The total amount expended on Public Works by the General Government, from the date of the Immigration and Public Works Act of 1870, and similar subsequent Acts, and under their authority, up to 31st December, 1878, is as under:—

On Railways	£7,638,135
,, Roads and bridges	976,083
,, Water Races on Gold Fields	465,626
,, Public Buildings and Improvements	449,676
,, Telegraphs	328,220
,, Land Purchases	705,039
,, Immigration	1,782,520
,, Lighthouses	81,240
,, Coal Mines	10,835
,, Miscellaneous Works..	215,395
Total	£12,652,739

ROADS.

A great deal of road making has been done in New Zealand.

The district roads are undertaken by the various Road boards. The total number of these boards in 1877 was 320, and their expenditure in the same year amounted to a total of £387,534, the whole being expended on public works, less the sum of £21,706 for expenses of administration.

Much road making has also been done by the General Government, especially in the North Island.

During the period extending from June, 1869, to June, 1879, the General Government expenditure in this department amounted to the sum of £975,552, the roads constructed being about 3,000 miles.

RAILWAYS.

Soon after the passing of the Immigration and Public Works Act in 1870, the construction of Railways on a large and systematic scale was commenced, and has proceeded vigorously since that time. The total length of lines open for traffic on the 30th June, 1879, was 1,140 miles; and there were under construction 142 miles.

The total amount of money expended in the construction of railways up to the date of 30th June, 1879, was £8,057,188.

The following table gives a view of the progress made in railway construction between the years 1870 and 1878. The small railway lines constructed by the late Provincial Governments prior to the Abolition of Provinces Act, are included in the total mileage constructed, but the cost of their construction and maintenance with the amounts received for traffic up to the time that the Act came into operation, are not taken into account in this table. The length of lines thus taken over amounted to about 70 miles.

Year.	Construction.	Maintenance.	Receipts.	Number of Miles.	
				Constructed.	Under Construction.
	£	£	£		
1870	467				
1871	108,106				
1872	292,851				
1873	830,945			145	434
1874	1,564,576	6,300	8,650	209	621
1875	1,780,674	38,142	21,198	524	464
1876	1,432,191	72,073	83,049	718	427
1877	756,047	359,865	470,796	1,052	251
1878	696,100	458,208	670,187	1,090	142

Diagram No. VIII. exhibits the comparative progress made in railway construction by New Zealand and Australian colonies during the years 1868-79.

Railway Receipts and Expenditure.

It will be seen by the official return below, which gives a very clear account of the working of the railways for twelve months ending 30th June, 1879, that the revenue for that period exceeded the expenditure by £212,618, the ratio of the latter to the former being 71·95 per cent. At the same time the receipts per mile averaged £666 15s. 8d., and the expenditure £473 9s. 3d.

Railways Working Account.

Showing the Total Receipts and Expenditure for a Period of Twelve Months during the Financial Year 1878-9, to the termination of the Four-weekly Period ending 30th June, 1879.

Section.	Length open for Traffic.	Four-weekly Receipts.	Total Receipts to Date.	Total Expenditure to Date.	Percentage of Expenditure to Receipts.	For a Twelvemonthly Period, Average to Date.	
						Receipts per Mile of Railway.	Expenditure per Mile of Railway.
	Miles.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Kaipara	16	358 10 4	4,992 17 4	4,955 18 10	99·26	312 1 0	309 15 0
Auckland	97	4,200 17 4	52,477 18 2	41,521 16 1	79·12	541 0 2	428 1 2
Napier	65	1,888 14 10	27,503 15 8	19,255 19 10	70·01	423 2 9	296 5 0
Wellington	45	2,098 17 4	30,401 6 5	22,919 11 7	75·39	764 8 9	576 6 2
Wanganui	95	2,836 16 7	35,171 16 1	22,614 2 7	64·30	408 3 0	262 8 7
New Plymouth ..	21	421 7 1	6,267 8 5	5,612 7 0	89·55	298 9 0	267 5 0
Greymouth	8	768 13 8	8,852 7 5	4,724 2 5	53·37	1,106 11 0	590 10 2
Westport	19	284 9 0	2,686 13 0	3,427 15 9	127·59	141 8 0	180 8 2
Nelson	20	490 18 1	7,111 6 0	6,029 3 11	84·78	355 11 4	301 9 2
Picton	18	348 16 2	5,270 10 6	4,841 2 5	91·85	292 16 2	268 19 0
Christchurch, Dunedin, and Invercargill ..	736	38,797 6 9	577,360 9 2	409,576 14 7	70·94	817 6 0	579 15 9
Totals	1,140	52,495 7 2	758,096 8 2	545,478 15 0	71·95	..	..

ELECTRIC TELEGRAPH.

The telegraph system is entirely in the hands of the Government. The difficulties to be overcome before telegraphic communication was generally established were of an unusual character, the country being to a large extent rugged and wild, while the islands being divided by Cook Strait, rendered it necessary to undertake the laying of a telegraph cable to connect them. The work, however, was pushed forward with great vigour. By July, 1878, 2,356 miles of line had been completed, carrying 4,574 miles of

wire, at a cost (inclusive of the submarine cable) of £224,580. The number of miles of line now open is 3,434; of wire, 8,035.

Telegraph Business.

The following figures show the telegraph business done during the years ending 31st December, 1878, and 31st December, 1879:—

	1878.	1879.
Number of Messages ..	1,356,863	1,412,087
Cash received	£78,468	£76,440
Value of Govt. Messages ..	£22,605	£28,802

According to the report of the Commissioner of Telegraphs, the receipts of the department for the financial year ending 30th June, 1879, including credit taken for the value of Government messages, show a balance over working expenses of £15,527, equal to 3·73 per cent. on the capital invested.

Telegraph Charges.

The large telegraph business indicated by the foregoing figures is doubtless due, in no small degree, to the introduction of a uniform and low scale of charges. For the first four years, a mileage rate was charged of from 2d. to 6d. per word. In 1869 this was altered to a uniform rate of 2s. 6d. for the first ten words, and 6d. for every additional five words. In 1870 the charge was reduced to 1s. for the first ten words, and 6d. for each additional five words; and in 1873 the charge was yet further reduced, any additional words over the first ten being rated at one penny for each word. More recently a still further reduction has been made for a certain class of messages classed under the somewhat awkward term of "delayed telegrams."

POST OFFICE.

The difficulty of communication, naturally incidental to a new and wild country like New Zealand, has been well met and mastered by an energetic and able postal organization, aided also by a very efficient telegraph system. In both services the policy has been to charge low rates, so as to give the public the greatest facilities for inter-communication.

The following figures taken from the last report of the Postmaster-general, will afford an indication of the extent to which these advantages have been made use of by the people.

Statistics for Year 1878.

The total number of letters, newspapers, post cards, and book packets received during the year for delivery in New Zealand, may be seen in the following table:—

Where from.	Letters.	Newspapers.	Post Cards.	Book Packets.
United Kingdom	445,703	1,267,479	—	126,784
Australian Colonies	296,771	422,106	—	37,658
Other places	52,609	66,095	—	7,618
From places within the Colony	7,440,979	3,342,227	116,674	333,234
Totals	8,236,062	5,097,907	116,674	505,294

Compared with the returns of the previous year, the letters increased 18·92 per cent., post cards 107·83 per cent., book packets 23·84 per cent., and newspapers 16·66 per cent.

The average number of letters posted in proportion to the estimated population was 16·85 to each person; the average in 1877 being 14·51. The increase of post cards, since their introduction in 1877, is very marked.

There were 814 post-offices open on the 31st December, 1878, 64 new offices having been opened during the year and 9 closed.

In the transaction of money order business, 101,017 orders were issued during the year for £368,254; an increase on the previous year of 10,345 orders, and £33,281. The money orders issued in New Zealand for payment in the United Kingdom and the Australian colonies were 30,486 in number for £117,393, and 4,788 orders for £20,532 were issued in those countries for payment in New Zealand. There was accordingly a balance of upwards of £96,000 remitted out of the colony by means of money orders.

The telegraph was used during the year for the transmission of 13,228 orders amounting to £54,807.

The total revenue of the Post office for the year was £129,906 showing an increase of £15,715 on the year previous. Taking into account the sum of £56,176 for official postage, the gross earnings of the department for the year amounted to £186,082, being £43,374 in excess of the expenditure. The total weight of the free correspondence forwarded through the several post offices, exceeded 122 tons.

The total revenue for the year 1879 was £141,448; the number of money orders issued 118,099, value £428,673; and the number of money orders paid, 88,791, value £319,200.

Postage Rates.

The charge for postage of letters, is, within towns, one penny per half ounce or fraction thereof, and double that rate for delivery in any part of the colony; the twopenny rate also franks letters to any part of Australia. Penny stamped post cards are also issued deliverable anywhere in New Zealand. The postage for book packets is at the rate of one penny for every two ounces, and the same scale applies to parcels coming within the category of the pattern and sample post. The limit of weight allowed for the Inland pattern and sample post, is twenty-four ounces, and for the book post, five pounds; and a packet by book post must not exceed two feet in length, or one foot in width or depth. The postage rate on newspapers is one half-penny within the colony, and double that sum for delivery in Australia and England.

GOVERNMENT LIFE ASSURANCE.

An Act was passed in 1869 empowering the Government to grant life assurances and annuities on the security of the colonial revenue, and the business was actually commenced in March, 1870. As may be seen by the statement below, from very small beginnings the business steadily increased; the total number of policies issued up to 30th June, 1879, being 12,869, representing an aggregate insurance amounting to £4,529,011.

It may be useful in this manual to notice the principal advantages offered to Policy-holders by the Government Insurance Department of New Zealand, which is the first British colony that has, by special legislation, and exceptional attractions, stimulated the growth of those self-dependent and provident habits, that lie at the root of the Life Assurance system. These advantages may be briefly stated as follows:—

1. The Inviolable Security offered to the assured, the payment of every policy being guaranteed by the colony under a special Act of Parliament.

2. The Division of Profits, the whole of which are by law to be divided amongst Policy-holders only—who thereby enjoy the advantages possessed by members of mutual companies, in addition to that of having the security of the colony for the payment of claims. The first quinquennial investigation showed a profit of over £12,000; the next investigation takes place on 30th June, 1880, and the surplus will then be divided.
3. The low scale of Premiums comes next in order. The Premiums are as low as the usual non-participating rates, and they entitle Policy-holders to a full share in the profits.
4. The Regulations affecting Policy-holders are framed in a very liberal spirit, and compare favourably with those of other institutions. Under these, policies contain no restrictive conditions as to voyaging, trade, or occupation. A Policy-holder may travel in any part of the world, or engage in any occupation. Admission of age is indorsed on policies when issued, if a certificate of birth or the best evidence available is produced. Policies are kept in force as long as the Surrender Value is sufficient to pay the premium in arrear and interest, and may be revived within twelve months after the Surrender Value is exhausted, on proof of unimpaired health, and payment of arrears. Policy-holders can borrow ninety per cent. of the Surrender Value of their policies. Policies are indisputable and unchallangeable after five years' duration, if age has been admitted.

The subjoined tabular statement will show the remarkable and steady growth of the business of the Department:—

Comparative Return of Policies Issued.

Financial Year.	Number of Policies.	Sum Assured.
1870	53	27,800
1870—71	409	178,674
1871—72	1,355	456,225
1872—73	1,161	429,450
1873—74	1,499	506,910
1874—75	1,450	498,715
1875—76	1,485	504,509
1876—77	1,409	563,928
1877—78	1,991	680,600
1878—79	2,057	682,200
	12,869	£4,529,011

EDUCATION.

STATE SCHOOLS, PRIVATE SCHOOLS.

The total number of common schools receiving Government aid, and under the control of Education Boards, was, in December, 1878, 748, having a total of 1,611 teachers, and with the names of 65,040 pupils on the books; the daily average attendance numbering 50,639. There were also at the principal centres of population superior schools, most of which have been endowed, directly or indirectly, with lands and money out of the public estate.

The number of private schools from which returns were received amounted, in December, 1877, to 252, the number of teachers being 568, viz., 162 males, and 406 females.

The public schools are free, and the instruction imparted in them is secular; the cost being defrayed by an annual parliamentary vote. For 1878 the expenditure was £306,679, of which £90,491 was for buildings. The average expenditure for each scholar in attendance was £6 3s. 9d., of which £1 17s. 6¼d. was for buildings. Some of the secondary schools, and the two collegiate institutions in Otago and Canterbury, are affiliated to the University, which is an examining body, having power to confer degrees, and to grant scholarships, and which is maintained by an annual grant from the consolidated revenue.

NATIVE SCHOOLS.

The number of schools established for the education of the Maori race amounted, during 1877, to 56. The number of pupils amounted to 1,088 males and 711 females, an increase, as compared with the previous year, of 94 males and 135 females. The number of instructors was 103, of whom 55 were males and 48 were females; of these four males and three females were of the Native race. The grants by the Government during 1877 on account of these schools amounted to £10,740.

Thirty-six European schools also received subsidies from the Government for the support of Maori pupils. 436 Maoris—viz., 231 males and 205 females, attended these schools, an increase on the previous year of 71 males and 85 females. The total number of Maori children thus receiving education in 1877 amounted to 2,235.

CONSTABULARY, VOLUNTEERS, FIRE BRIGADES.

CONSTABULARY.

The total strength of the Armed Constabulary on the 31st December, 1878, amouted to 840 men of all ranks, distributed over 213 posts. There were 38 officers, 142 non-commissioned officers and 660 rank and file. As the total strength of the force in December, 1876, amounted to 610 of all ranks, there is an apparent increase in the strength of the force since that date of 214 men. This increase is attributed to the fact that in the abolition of the provincial system of goverment, the police of the colony, formerly under the provincial control, were taken over by the General Government and sworn in as members of the Armed Constabulary. They are drilled as such, and are therefore available for actual service in the field in any part of the colony, their general duties, however, being of an ordinary police character. The number of the force thus occupied in police duties amounted in 1878 to 457, leaving 367 of all ranks retained at posts to perform duties of a military character.

VOLUNTEERS.

The various branches of the Volunteer Force in December, 1878, gave a total strength of 8,076 officers and men belonging to 123 corps. The total of each branch of the service were as follows:—

	Corps.	Strength.
Cavalry	9 ..	601
Artillery	10 ..	427
Engineers	5 ..	406
Rifles	54 ..	3,597
Naval	5 ..	523
Cadets	40 ..	2,222

FIRE BRIGADES.

In 1878 there were 27 Fire Brigades in the colony, having a total strength of 94 officers and 681 men.

APPENDIX.

DESCRIPTIVE LIST OF THE PRINCIPAL FOREST TREES OF NEW ZEALAND.

Order Coniferæ. Genus Dammara (L'Héritier).

Dammara australis (Lambert).

Kauri.—The kauri is the finest forest tree in New Zealand, and attains a height from 120–160 feet. The trunk is sometimes 80–100 feet high before branching, and attains a diameter at the base of 10 to 20 feet.

The timber is in high repute for masts and spars, deck and other planking of vessels, and is largely used for house finishings. There is abundant evidence of its durability for more than 50 years in some of the old mission buildings at the Bay of Islands, the buried logs of an ancient Kauri forest near Papa Kura were excavated and found to be in perfectly sound condition, and were used for sleepers on the Auckland and Waikato Railway. On the Thames goldfield it is used for mine props, struts and cap pieces. It forms the bulk of the timber exported from New Zealand.

Some of the largest and soundest kauri timber has richly mottled shading, which appears to be an abnormal growth, due to the bark being entangled in the ligneous growth, causing shaded parts, broad and narrow, according as the timber is cut relative to their planes. This makes a rich and valuable furniture wood, and in the market is known as "mottled kauri."

The kauri pine occurs only in the North Island, and north of Mercury Bay, and grows best near the sea, on wet clay land. The kauri forests are largely composed of other trees, as well as their characteristic tree.

The turpentine of this tree forms the celebrated kauri gum, which is extensively excavated from the sites of old forests as far south as Taranaki. In 1871 there were exported 5,053 tons, valued at £167,958; in 1875 2,230 tons, valued at £138,528; and in 1877, 3632 tons, valued at £118,348.

Genus Libocedrus (Endl.)

Libocedrus doniana (Endl.)

Kawaka, Cypress, Cedar.—This noble tree attains a height of from 60-100 feet, and 3–5 feet diameter. Wood reddish, fine grained and heavy, used by the Maoris for carving, and said to be excellent for planks and spars; grows in the North Island, being abundant in the forests near the Bay of Islands and North of Auckland.

Libocedrus bidwillii (Hook.)

Pahautea, Cedar.—A handsome conical tree 60–80 feet high, 2–3 feet in diameter. In Otago, it produces a dark red free-working timber, rather brittle, chiefly adapted for inside work. Found on the central ranges of the North Island, and common throughout the forests of the South Island, growing at altitudes of from 500 to 4,000 feet. This timber has been used for sleepers on the Otago railways of late years, is largely employed in that district for fencing purposes, and is frequently mistaken for totara. In former years it was believed to be suitable only for inside work.

Genus Podocarpus (L'Héritier).

Podocarpus ferruginea (Don.)

Miro, called Bastard Black Pine in Otago.—A large ornamental and useful timber tree, attains a height from 40–60 feet, trunk 2–3 feet in diameter. A useful wood, but not so durable as the matai or true black pine wood; reddish close grained and brittle; the cross section of the timber shows the heart wood star-shaped and irregular. The timber is generally thought to be unfitted for piles and marine works, except when only partially exposed to the influence of sea water, as shown in the railway embankment at the Bluff Harbour, where it is reported to have been durable. Grows in the North and Middle Island, and in Otago, at altitudes below 1,000 feet.

Podocarpus totara (A. Cunn.)

Totara.—A lofty and spreading tree 60 to 120 feet high, 4–10 feet in diameter. Wood very durable and clean-grained, in appearance like cedar, and works with equal freedom; it is adapted for every kind of carpenters' work. It is used extensively in Wellington for house building and piles for marine wharves and bridges, and railway sleepers, and is one of the most valuable timbers known. The wood, when felled during the growing season, resists for a longer time the attacks of teredo worms; it splits freely and is durable as fencing and shingles. Totara post and rail fences are expected to last from 40 to 50 years. The Maoris made their largest canoes from this tree, and the palisading of their pas was constructed almost entirely of this wood.

Grows throughout the North and Middle Islands upon both flat and hilly ground; the timber from trees grown on hills is found to be the most durable.

Podocarpus spicata (Br.)

Matai or Mai.—Black pine of Otago. A large tree 80 feet high, trunk from 2–4 feet in diameter. Wood yellowish, close grained and durable; used for a variety of purposes—piles for bridges, wharves, and jetties, bed-plates for machinery, millwrights' work, flooring, house-blocks, railway-sleepers, and fencing. Bridges in various parts of the colony afford proof of its durability. Mr. Buchanan has described a log of matai that he found had been exposed for at least 200 years in a dense damp bush in North-east Valley, Dunedin, as proved by its being enfolded by the roots of three large trees of Griselina littoralis, 3 feet 6 inches in diameter, with over 300 growth rings. Grows in both North and South Islands at altitudes under 1,500 feet.

Podocarpus dacrydoides (A. Rich.)

Kahikatea.—White pine. A very fine tree 100–150 feet high, trunk 4 feet in diameter. Timber white and tough, soft, and well adapted for indoor work, but will not bear exposure.

Abundant throughout the Northern and Middle Islands; when grown on dry soil it is good for the planks of small boats, but when from swamps it is almost useless. A variety of this tree, known as yellow pine, is largely sawn in Nelson, and considered to be a durable building timber.

Genus, Dacrydium.

Dacrydium cupressinum (Soland.)

Rimu.—Red pine. Tree, Pyrimidal, with weeping branches, when young, trunk 80 feet to 130 feet high, and 2–6 feet in diameter.

An ornamental and useful timber; wood red, clear grained, heavy, and solid, much used for joisting and planking, and general building purposes, from Wellington southward. Its chief drawback is in being liable to decay under the influence of wet. It is largely used in the manufacture of furniture, the old wood being handsomely marked like rosewood, but of a lighter brown hue.

The juice of this pine is agreeable to drink, and was manufactured into spruce beer by Captain Cook.

Grows throughout the Northern and Southern Islands, but is of best quality in the South.

Dacrydium colensoi (Hook.)

Monoao.—Yellow pine. A very ornamental tree from 20 to 80 feet high. Wood light yellow. It is the most durable and strongest timber in New Zealand. Posts of this wood have been in use among the Maoris for several hundred years. Grows in Northern and Southern Islands up to 4,000 feet altitudes. This tree is curious from having two kinds of leaves on the same branches. It is greatly valued for furniture.

Genus, Phyllocladus.

Phyllocladus trichomanoides (Don.)

Tanekaha.—Celery leaved pine. A slender, handsome tree, 60 feet high, trunk rarely exceeds 3 feet in diameter; wood pale, close grained, and excellent for planks and spars; resists decay in moist positions in a remarkable manner.

Grows in the North Island, especially in the hilly districts.

Phyllocladus Alpinus (Hook.)

Toa toa.—A small ornamental and densely branched tree, sometimes 2 feet in diameter. Bark used for dyeing and making tar. Found in both North and Middle Islands.

Order, Cupuliferæ. Genus, Fagus (Linn.)

Fagus Menziesii (Hook.)

Towai.—Red birch (from the colour of the bark). A handsome tree, 80 to 100 feet high, trunk 2–3 feet in diameter. The timber is chiefly used in the lake district of the South Island. Durable and adapted for mast-making and oars, and for cabinet and coopers' work.

Grows in the North Island on the mountain-tops, but abundant in the South Island at all altitudes to 3,000 feet.

Fagus fusca (Hook.)

Tawhai, or Tawhai-rau-nui.—Black birch of Auckland and Otago (from colour of bark). Red birch of Wellington and Nelson (from colour of timber). This is a noble tree from 60–90 feet high, the trunk 5–8 feet in diameter. The timber is excessively tough and hard to cut. It is highly valued in Nelson and Wellington as being both strong and durable in all situations.

It is found from Kaitaia in the North Island to Otago in the South Island, but often locally absent from extensive districts, and grows at all heights up to 3,000 feet altitude.

Fagus solandri (Hook.)

White birch of Nelson and Otago (from colour of bark). Black-heart birch of Wellington. A lofty, beautiful evergreen tree 100 feet high, trunk

4–5 feet in diameter. The heart timber is darker than that of *Fagus fusca*, and is very durable. This wood is well adapted for fencing and bridge piles, and the bark is useful as a tanning material.

This tree occurs only in the southern part of the North Island, but is abundant in the South Island from 3–5,000 feet.

Order, Myrtacæ.—Genus, Leptospermum (Forst.)

Leptospermum scoparium (Forst.)

Kaikatoa.—Tea-tree of Cook. It is ornamental, and useful for fuel and fencing; generally a small scrub, but occasionally 20 feet in height in the south.

Abundant throughout the islands.

Leptospermum erecoides (A. Rich.)

Manuka.—A small tree 10–80 feet high, highly ornamental, more especially when young. The timber can be had 28–30 feet long, and 14 inches in diameter at the butt, and 10 inches at the small end. The wood is hard and dark coloured, largely used at present for fuel and fencing, axe-handles and sheaves of blocks, and formerly by the natives for spears and paddles.

The old timber, from its dark-coloured markings, might be used with advantage in cabinet work, and its great durability might recommend it for many other purposes. Highly valued in Otago for jetty and wharf piles, as it resists the marine worm better than any other timber found in the district. It is extensively used for house piles. The lightest coloured wood, called "white manuka," is considered the toughest, and forms an excellent substitute for the "hornbeam" in the cogs of large spur wheels. It is abundant as a scrub, and is found usually on the poorer soils, but is rare as a tree in large tracts to the exclusion of other trees.

Genus, Metrosideros (Br.)

Metrosideros lucida (Menzies).

Rata.—Ironwood. A very ornamental tree; attains a height from 30–60 feet, and a diameter of from 2–10 feet. The timber of this tree forms a valuable cabinet wood; it is of a dark red colour; splits freely.

It has been much used for knees and timbers in shipbuilding, and would probably answer well for cogs of spur wheels.

Grows rarely in the North Island, but is abundant in the South Island, especially on the west coast.

Metrosideros robusta (A. Cunn.)

Rata.—A tall erect tree 50–60 feet high, diameter of trunk 4 feet, but the descending roots often form a hollow stem 12 feet in diameter. Timber closely resembles the last-named species, and is equally dense and durable, while it can be obtained of much larger dimensions. It is used for shipbuilding, but for this purpose is inferior to the pohutukawa. On the tramways of the Thames it has been used for sleepers, which are perfectly sound after five years' use. Grows in the North Island; usually found in hilly situations from Cape Colville southwards.

Metrosideros tomentosa (A. Cunn.)

Pohutukawa.—This tree has numerous massive arms; its height is from 30–60 feet; trunk 2–4 feet in diameter.

The timber is specially adapted for the purposes of the shipbuilder, and has usually formed the framework of the numerous vessels built in the northern provinces. Grows on rocky coasts, and is almost confined to the province of Auckland.

Order, Meliaceæ. Genus, Dysoxylum (Blum.)

Dysoxylum spectabile (Hook.)

Kohekohe.—A large forest tree 40–50 feet high. Leaves are bitter, and used to make a stomachic infusion; wood tough, but splits freely, and is considered durable as piles under sea water. Grows in the North Island.

Genus, Eugenia.

Eugenia maire (A. Cunn.)

Mairetawhake.—A small tree about 40 feet high; trunk 1–2 feet in diameter. Timber compact, heavy, and durable. Used for mooring-posts and jetty-piles on the Waikato, where it has stood well for seven years. It is highly valued for fencing. Common in swampy land in the North Island.

Order, Onagrarieæ. Genus, Fuchsia (Linn.)

Fuchsia excorticata (Linn.)

Kotukutuku. The fruit is called Konini.—A small and ornamental tree 10-30 feet high; trunk sometimes 3 feet in diameter. It appears to furnish a durable timber. House blocks of this which have been in use in Dunedin for more than 20 years are still sound and good. The wood might be used as dye stuff, if rasped up and bled in the usual way, and by mixing iron as a mordant, shades of purple may be produced even to a dense black, that makes good writing ink. The juice is astringent and agreeable, and yields a medicinal extract. Its fruit is pleasant, and forms a principal food of the wood pigeon. Grows throughout the islands.

Order, Araliacæ. Genus, Panax (Linn.)

Panax crassafolium (Dem. and Plach.)

Horoeka, Ivy Tree.—An ornamental slender and sparingly branched tree. It has a singularly graceful appearance in the young state, having long reflexed leaves. The wood is close grained and tough. Common in forests throughout the islands.

Order, Corneæ. Genus, Griselinia (Forst.)

Griselinia littoralis (Raoul.)

Puka, Broadleaf.—An erect and thickly branched bush trees 50–60 feet high; trunk, 3–10 feet in diameter. Wood splits freely, and is valuable for fencing and in shipbuilding; some portions make handsome veneers. Grows chiefly in the South Island and near the coasts.

Order, Compositæ. Genus, Olearia (Mænch.)

Olearia avicenniæfolia (Hook.)

Mingimingi. Yellowwood.—An ornamental shrub tree, flowers numerous, trunk 2 feet in diameter. Wood close grained, with yellow markings, which render it desirable for cabinet work; wood good for veneers. Occurs in South Island.

Olearia nitida.

An ornamental shrub tree, 20 feet high and 2 feet in diameter. Wood close grained, with yellow markings; useful for cabinet work. Found in the mountainous region of the North Island and throughout the South Island.

Olearia Cunninghamii.

An ornamental shrub tree, 12–20 feet high, with very showy flowers. Found abundantly on west coast of South Island, and not uncommon in North Island.

Order, Ericeæ. Genus, Dracophyllum (Lab.)

Dracophyllum longifolium (Br.)

Neinei.—An ornamental shrub tree with long grassy leaves. Wood is white, marked with satin-like specks, and is adapted for cabinet work. Grows in South Island and in Lord Auckland's group and Campbell's Island; none of the South Island specimens are as large in the foliage as those in Auckland Islands. The tree in the vicinity of Dunedin attains a diameter of 10 to 12 inches.

Order, Verbenaceæ. Genus, Vitex.

Vitex littoralis (A. Cunn.)

Puriri.—A large tree, 50–60 feet high, trunk 20 feet in girth. Wood hard, dark olive brown, much used; said to be indestructible under all conditions. Grows in the northern parts of the North Island only.

Order, Laurineæ. Genus, Nesodaphne (Hook.)

Nesodaphne tarairi (Hook.)

Tarairi.—A lofty forest tree, 60–80 feet high, with stout branches. Wood white, splits freely, but not much valued. Grows in northern parts of North Island.

Nesodaphne tawa (Hook.)

Tawa.—A lofty forest tree, 60–70 feet high, with slender branches. The wood is light and soft, and is much used for making butter kegs. Grows in the northern parts of the South Island, and also on the North Island, chiefly on low alluvial grounds; is commonly found forming large forests in river flats.

Order, Momiacæ. Genus, Atherosperma (Lab.)

Atherosperma novæ-zealandia (Hook.)

Pukatea.—Height, 150 feet, with buttressed trunk 3–7 feet in diameter; the buttresses 15 feet thick at the base; wood soft and yellowish, used for small boat planks. A variety of this tree has dark coloured wood that is very lasting in water, and greatly prized by the natives for making canoes. Grows in the North Island, and northern parts of the Middle Island.

Genus, Hedycarya (Forst.)

Hedycarya dentata (Forst.)

Kaiwhiria.—A small evergreen tree 20–30 feet high; the wood is finely marked and suitable for veneering. Grows in the North and South Island as far south as Akaroa.

Order, Proteaceæ. Genus, Knightia (Br.)

Knightia excelsa (Br.)

Rewarewa.—A lofty slender tree 100 feet high. Wood handsome, mottled red and brown, used for furniture and shingles, and for fencing, as it splits easily. It is a most valuable veneering wood. Common in the forests of the Northern Island, growing upon the hills in both rich and poor soils.

Order, Magnoliaceæ. Genus, Drimys.

Drimys axillaris (Forst.)

Horopito.—Pepper tree of colonists, and Winter's Bark. A small slender evergreen tree, very handsome. Whole plant aromatic and stimulant, used by the Maoris for various diseases. Wood very ornamental in cabinet work, making handsome veneers. Grows abundantly in forests throughout the islands. At altitudes of 1,000 feet the foliage becomes dense and reddish coloured.

Drimys colorata (Raoul.)

This is a very distinct species, very common near Dunedin; it is a very ornamental shrub-tree, with leaves blotched with red.

Order, Violarieæ. Genus, Melicytus (Forst.)

Melicytus ramiflorus (Forst.)

Mahoe, or Hinahina.—A small tree 20–30 feet high, trunk often angular, and 7 feet in girth. The wood is soft and not in use. Abundant throughout the Islands as far south as Otago, leaves greedily eaten by cattle.

Order, Malvaceæ. Genus, Hoheria (A. Cunn.)

Hoheria populnea (A. Cunn.)

Houhere.—Ribbon wood of Dunedin. An ornamental shrub-tree 10–30 feet high. Bark fibrous and used for cordage, and affords a demulcent drink. Wood splits freely for shingles, but is not durable. Grows abundantly throughout the islands. Bark used for making a tapa cloth by the Natives in olden times.

Order, Tiliaceæ. Genus, Aristotelia.

Aristotelia racemosa (Hook.)

Mako.—A small handsome tree 6–20 feet high, quick growing, with large racemes of reddish nodding flowers. Wood very light, and white in colour, and might be applied to the same purposes as the lime tree in Britain; it makes good veneers.

Genus, Elæocarpus (Linn.)

Elæocarpus dentatus (Vahl.)

Hinau.—A small tree, about 50 feet high, and 18 inches thick in stem, with brown bark which yields a permanent blue-black dye, used by the Maoris for colouring mats and baskets, and is used for tanning. Wood a yellowish brown colour and close grained, very durable for fencing and piles. Common throughout the islands.

Order, Olacineæ. Genus, Pennantia (Forst.)

Pennantia corymbosa (Forst.)

Kaikomako.—A small, very graceful tree, with white sweet smelling flowers; height 20–30 feet. Wood used by the Natives for kindling fires by friction. Grows on the mountains of the Northern Island, and more abundantly throughout the Middle Island.

Order, Rhamnæ. Genus, Discaria (Hook.)

Discaria toumatou (Raoul.)

Tumatakuru.—"Wild Irishman" of settlers. A bush or small tree with spreading branches; if properly trained would form a handsome hedge that would be stronger than white thorn. The spines were used by the Natives for tattooing.

Order, Sapindaceæ. Genus, Dodonæa (Linn.)

Dodonæa viscosa (Forst.)

Ake.—A small tree 6–12 feet high. Wood very hard, variegated black and white, used for Native clubs, abundant in dry woods and forests.

Genus, Alectryon (Gartner.)

Alectryon excelsum (D.C.)

Titoki.—A beautiful tree with large panicles of reddish flowers. Trunk 15–20 feet high, and 12–20 inches in diameter. Wood has similar properties to ash, and is used for similar purposes. Its toughness makes it valuable for wheels, coach building, &c., the oil of the seeds was used for anointing the person. Grows in the North and Middle Island, not uncommon in forests.

Order, Coriariæ. Genus, Coriaria (Linn.)

Coriaria ruscifolia (Linn.)

Tupakihi.—Tree tutu. A perennial shrub 10–18 feet high, trunk 6–8 inches in diameter.

The so-called berries (fleshy petals) vary very much in succulence, the less juicy bearing seeds which, according to Colenso, are not poisonous. The juice is purple, and affords a grateful beverage to the natives; and a wine, like elderberry wine, has been made from them. The seeds and leaves contain a poisonous alkaloid, and produce convulsions, delirium, and death, and are sometimes fatal to cattle and sheep. Abundant throughout the islands.

Order, Leguminosæ. Genus, Sophora (Linn.)

Sophora tetraptera (Aiton).

Kowhai.—A small or middling-sized tree. It has a splendid appearance, with large pendulous yellow flowers. Wood red; valuable for fencing, being highly durable; it is also adapted for cabinet work. It is used for piles in bridges, wharves, etc. Abundant throughout the islands.

Order, Saxifrageæ. Genus, Carpodetus (Forst.)

Carpodetus serratus (Forst.)

Tawiri.—White mapau, or white birch (of Auckland). A small tree 10–30 feet high; trunk unusually slender; branches spreading in a fan-

shaped manner, which makes it of very ornamental appearance; flower-white, profusely produced. The wood is soft and tough, and might be used in the manufacture of handles for agricultural implements and axe handles. Grows in the Northern and Southern Islands; frequent by the banks of rivers.

Genus, Weinmannia (Linn.)

Weinmannia racemosa (Forst.)

Towhai; Kamahi.—A large tree; trunk 2–4 feet in diameter, and 50 feet high. Wood close-grained and heavy, but rather brittle; might be used for plane-making and other joiners' tools, block cutting for paper and calico printing, besides various kinds of turnery and wood engraving. The bark of this tree is largely used for tanning. The extract of the bark is chemically allied to the gum *kino* of commerce, their value being about equal. Grows in the middle and southern parts of the Northern Island and throughout the Southern Island.

Order, Rubiaeæ. Genus, Coprosma (Forst.)

Coprosma linariifolia (Hook.)

Karamu.—An ornamental shrub tree; wood close-grained and yellow; might be used for turnery. Grows in mountain localities of the North and South Island.

Several other species of this genus grow to a considerable size, and have ornamental timber. It has been proposed to use the berries of some species as a substitute for coffee.

Order, Jasmineæ. Genus, Olea (Linn.)

Olea cunninghamii (Hook., fil.)

Black Maire.—40–50 feet high, 3–4 feet in diameter; timber close-grained, heavy, and very durable. Much of this very valuable timber is at present destroyed in clearing the land.

Order Santalaceæ. Genus, Santalum (Linn.)

Santalum cunninghamii (Hook., fil.)

White Maire.—A small tree 10–15 feet high, 6–8 inches in diameter; wood hard, close-grained, heavy. Used by the natives in the manufacture of war implements. Has been used as a substitute for box by wood engravers.

MINERAL WATERS.

PRINCIPAL MINERAL SPRINGS.

New Zealand is singularly rich in springs of water that hold Mineral Salts in solution, and some of these are already noted for their valuable medicinal properties.

Both hot and cold springs are found, the former being with few exceptions confined to the districts of the North Island where volcanic forces have been active during the latest tertiary period, and are not yet altogether dormant. A few thermal springs are found to escape from the Upper Mesozoic rocks, in localities where the source of heat can only be attributed to chemical decomposition of bituminous matters and sulphides, and in a few instances, warm waters spring from Palæozoic rock formations in the South Island. The cold mineral springs have a wider distribution, but have only, as yet, been examined from comparatively few localities.

The mineral waters of New Zealand may be classified, from the analysis that have been made in the Colonial Laboratory, into the following groups :—

Saline.—Containing chiefly chloride of sodium.

Alkaline.—Containing carbonates and bicarbonates of soda and potash.

Alkaline Siliceous.—Waters containing much silicic acid, but changing rapidly on exposure to the atmosphere, and becoming alkaline.

Hepatic or Sulphurous.—Waters, the prominent character of which is he presence of Sulphurreted hydrogen and Sulphurous acid.

Acidic Waters.—In which there is an excess of Mineral acids, such as Hydrochloric and Sulphuric acid.

The following is a list of the best known Mineral Springs, full details concerning which are to be found in the Official Laboratory Reports, "Transactions of the New Zealand Institute," and other similar publications :—

PRINCIPAL MINERAL SPRINGS.

No.	Name and District.	Temp. Fahr.	Solid Grains, Per pint.	Chemical Character.	No.	Name and District.	Temp. Fahr.	Solid Grains, Per pint.	Chemical Character.
		Deg.					Deg.		
1	Ohaeawai, Auckland ..	60-116	16·8	Acid, Aluminous	27	Alum Cave Spring, Taupo ..	60	7·1	Sulphurous
2	Waiwera ,, ..	110	17·7	Alkaline, Saline	28	Crow's Nest Spring ,, ..	170	18·0	Saline
3	Puriri ,, ..	60	67·1	Alkaline, Carbonates	29	Waipakahi ,, ..	98-120	2·8	Sulphurous
4	White Island Lake, Bay of Plenty ..	97-212	1850·8	Strongly Acidic	30	Te Hukahuka ,, ..	116	1·8	Sulphurous
5	White Island Springs, Bay of Plenty ..	210	207·7	Strongly Acidic	31	Tarawera ,, ..	130	12·5	
					32	Parkes' Spring ,, ..	Cold	25·1	
					33	Wangape, Waikato ..	160-200	6·0	Alkaline
6	Pink Terrace Geyser, Rotomahana ..	208	19·3	Sulphurous	34	Onetapu ,, ..	70	58·0	
					35	Roparoa, Waiapu ..	Cold		Saline, Bituminous
7	White Terrace Geyser, Rotomahana ..	210	18·0	Alkaline	36	Manutahi ,, ..	Cold		Saline, Bituminous
8	Turikore, Whakatewarewa ..	96-120	10·9	Sulphurous					
9	Te Koutu Spring, Rotorua ..	90-180	9·1	Alkaline	37	Pepoti ,, ..	Cold		Hydro-Carbon Gas
10	Koreteoteo ,, ..	214	13·0	Alkaline Caustic					
11	Kuirua ,, ..	136-156	9·9	Alkaline	38	Waipaoa, Poverty Bay ..	Cold		Bituminous
12	Manupirua, Rotoiti ..	107	4·1	Sulphurous	39	Waipiro, Waiapu ..	144		Calcareous, Bituminous
13	Cameron's Bath ,, ..	109-115	14·3	Acid					
14	Ariki-kapakapa ,, ..	160	6·6	Acid	40	Wallingford, Wellington ..	60	10·4	Acid
15	Perekari ,, ..	130-150	7·0	Acid	41	Pahua ,, ..	Cold	184·2	Alkaline
16	Ti Kute ,, ..	100-212	6·1	Sulphurous	42	Burton's Spring ,, ..	Cold		
17	Te Mimi ,, ..	90-112	3·8	Acid	43	Akatea (*a*) ,, ..	Cold	62·4	Alkaline
18	Te Kauwhanga ,, ..	80-100	8·0	Acid	44	,, (*b*) ,, ..	Cold	4·8	Sulphurous
19	Painkiller Bath ,, ..	204	16·0	Acid	45	Hanmer Plain Springs, Amuri ..	90-104	10·8	Alkaline
20	Sulphur Bay Spring,, ..	90-100	5·6	Acid					
21	Otumuhika (*a*) Taupo ..	100-150	1·5	Sulphurous	46	Sumner Lake Springs, Huranui ..	93	2·3	Acid, Saline
22	,, (*b*) ,, ..	150	3·4	Sulphurous					
23	,, (*c*) ,, ..	78	1·2	Sulphurous	47	Amberley Spring, Canterbury	Cold	11·7	Chalybeate
24	Ruahine ,, ..	190	19·1	Sulphurous	48	Wickliffe Bay Spring, Otago		34·6	Saline
25	Orakeikorako ,, ..	90-106	10·6	Acid	49	Gibson's Spring, Southland	Cold	2·3	Alkaline
26	McMurray's Bath ,, ..	126	4·2	Sulphurous					

1. Ohacawai, Auckland. A group of springs used as baths, 17 miles from Bay of Islands, the waters of which are acidic, depositing sulphur and alum on cooling. Silica is only deposited as a granular sediment. These springs are chiefly interesting from their being accompanied by an escape of mercurial vapour which deposits cinnabar and metallic mercury. Their medicinal action is tonic and chalybeate, and having a specific alterative action in skin diseases.

Analysis.—Grains in one Gallon.

Protoxide of iron	2·23
Lime	5·97
Magnesia	1·15
Silica	3·10
Sulphuric acid	13·60
Hydrochloric acid	66·91
Sulphuretted hydrogen	traces
Fixed alkalies	41·66
Ammonia	traces
Organic matter	,,
	134·62

2. Waiwera, on the coast, 30 miles north of Auckland. A powerful escape of weakly alkaline and saline water, extensively used as baths in rheumatic and dyspeptic complaints; used internally it has also a mild antilithic action. This spring is largely resorted to, and most comfortable accommodation is provided for visitors.

Analysis.—Grains in one Gallon.

Chloride of sodium	116·715
,, ,, potassium	·091
,, ,, lithium	traces
Iodide of magnesium	traces
Sulphate of soda	·383
Bi-carbonate of soda	87·513
,, ,, lime	10·692
,, ,, magnesia	·954
,, ,, iron	·683
Alumina	traces
Silica	2·464
	219·495

3. Puriri, about 10 miles from Grahamstown. A cold effervescent water, having valuable properties from the presence of a large percentage of alkaline carbonates. It is bottled both as still and ærated water, and is coming into repute as an antilithic aperient, and would probably be useful in cases of acid dyspepsia and in disorders of the kidney and bladder. In chemical properties it approaches very closely to Fachingen & Ems' waters, of Nassau in Germany.

Analysis.—Grains in one Gallon.

Chloride of sodium	21·938
Iodide of magnesium	traces
Sulphate of soda	·940
,, ,, potash	4·938
Carbonate of iron	traces
Bi-carbonate of lime	28·506
,, ,, magnesia	25·625
,, ,, soda	452·393
,, ,, lithia	traces
Silica	2·772
Phosphoric acid	not determined
	537·112

4–5. White Island. A conical island in the Bay of Plenty formed by the summit of an extinct volcanic mountain rising out of deep water. The

crater is occupied by a lake of strong mineral water which is fed by intermittent geysers and boiling springs which surround it. All these waters are intensely acid, and deposit sulphate of lime, while the accompanying vapours form extensive deposits of pure sulphur. These waters are too powerful to be used medicinally in their natural state, but might be turned to valuable account in certain chemical manufactures.

Analysis (No. 4).—Grains in one Gallon.

Sulphate of iron	1163·980
,, ,, soda	680·325
,, ,, potash	297·124
,, ,, lime	251·682
,, ,, magnesia	66·312
,, ,, alumina	87·668
Sesquichloride of alumium	1870·085
Siliceous matters	23·628
Hydrochloric acid, free	10409·589
	14850·393

Analysis (No. 5).—Grains in one Gallon.

Sulphate of lime	115·933
,, ,, soda	9·240
,, ,, magnesia	29·120
,, ,, potash	traces
,, ,, protoxide of iron	23·573
,, ,, alumina	traces
,, ,, ammonia	traces
Silicic acid, free	9·013
Sulphurous acid	traces
Phosphoric acid	traces
Sulphuric acid, free	11·933
Hydrochloric acid, free	9·706
	208·518

6–20. Are associated geographically as all coming from the famous Rotorua and Rotomahana districts. They however present considerable variety in quality, and may be classed as follows :—

6–11. Alkaline and Siliceous waters. These differ from the ordinary alkaline waters in the presence of silicic instead of carbonic acid as the combining agent. They are remarkable from their building extensive mounds and terraces composed of silica deposited by the cooling water and involving as it solidifies a certain amount of granular silica which is held in mechanical suspension ; in this manner the wonderful white and pink terraces of Rotomahana, and the domes of Whakarewarewa, have been formed. When used as baths they have an undoubted alterative action, and are especially useful in rheumatic affections, especially in gouty constitutions ; this is probably due to the specific action of silicates in promoting the discharge of uric acid from the system, as has lately been pointed out by French chemists.

12. This water, which is reported to possess valuable curative properties in rheumatic affections, has an intermediate character, and is allied to the first group owing to the small amount of salines and the presence of alkaline silicates in moderate quantity, but it differs from that group in its deficiency of sulphates, and in being harsh to the feel.

13–20. Acidic Waters. In the case of these waters the carbonates have been wholly eliminated, and the alkaline salts are formed by a mineral acid, either sulphuric or hydrochloric. In some cases, such as 13 and 14, and 17 to 20, the acid is greatly in excess, forming a bath which has a powerful action upon the liver and upon diseases dependent on the derangement of that important organ. In numbers 16, 18, and 19, the presence of sulphurous and hydro-sulphuric acid gives these baths great efficacy in cutaneous diseases.

ANALYSIS OF MINERAL WATERS; Numbers 6 to 20

(Rotorua and Rotomahana Districts).

	Respective Numbers as per List.														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Silicates of Soda	..	68·48	16·32	32·12	2·08	2·57									
,, ,, Lime	1·91	1·62	1·61	1·62	3·16	·34	1·51								
,, ,, Magnesia	1·16	·53	1·14	·40	·76	·12	·77								
,, ,, Iron	..	·51	·39	·67	·85	·31	·99								
Silica	43·95	..	..	..	22·40	18·42	8·53	7·01	18·15	18·17	12·40	4·12	13·86	16·09	10·08
Sulphate of Soda	1·01	7·84	13·47	7·06	7·49	10·31	11·50	33·47	12·51	26·75	12·66	4·78	23·71	34·37	8·37
,, ,, Potash	..	..	..	..	..	..	..	·94	·38	..	·59	·13	·77	2·96	·07
,, ,, Alumina	..	..	..	..	..	..	..	traces	·68	traces	11·22	traces	1·46	..	traces
,, ,, Lime	10·96	..	..	..	..	..	2·43	2·11	2·21	2·45	1·01	2·04	2·04	..	2·50
,, ,, Magnesia	..	..	..	..	..	..	..	1·14	1·29	1·86	·69	·93	1·62	..	·93
,, ,, Iron	..	..	..	..	..	..	..	1·20	3·15	·76	1·73	·23	1·47	..	2·68
Chloride of Sodium	93·55	62·61	53·61	29·94	66·34	45·70	6·25	..	..	..	..	..	..	59·16	
,, ,, Potassium	1·05	2·87	1·24	·97	1·46	2·08	·47	..	..	·63					
,, ,, Calcium	..	..	..	..	..	..	..	..	..	..	..	..	..	3·33	
,, ,, Magnesium	..	..	..	..	..	..	..	..	..	..	..	..	..	1·27	
,, ,, Iron	..	..	..	..	..	..	..	..	..	..	..	..	..	·25	
Phosphate of Alumina	·54	traces	traces	traces	traces	traces	..	traces	traces	traces	..	traces	traces	traces	traces
Phosphoric Acid	..	..	..	..	..	..	..	..	..	..	traces				
Lithia	..	traces	..	..	traces										
Iron Oxides	traces														
Hydrochloric Acid, free	..	..	..	..	..	..	..	7·28	2·62	5·38	1·63	3·82	7·66	7·60	·86
Sulphuretted Hydrogen	..	..	..	..	..	..	..	·41	..	..	5·74	·98	3·19	2·01	1·01
Sulphuric Acid, free	..	..	..	..	..	..	..	76·79	13·95	..	·77	12·48	7·60	..	18·02
Total Contents	154·1	144·43	87·78	72·78	104·54	79·85	32·45	130·35	54·94	56·00	48·44	29·51	63·38	127·04	44·52

21–32. These waters are all from the neighbourhood of Taupo Lake, and are characterized by having iodine present as a usual constituent, an important element, which is wanting in almost all the waters previously referred to. In general character they are saline and faintly acid, and are suitable for internal and external use, as alteratives, in scorbutic and tubercular diseases, also in chronic nervous affections and cutaneous eruptions. This is especially the case in numbers 31 and 32; the composition of these is given in more detail on account of their importance. Number 31 is similar to the cold spring at Labassère (Hautes Pyrennes) which is used in bronchial catarrh, but it is much stronger. Number 32 is a carbonated and slightly effervescent alkaline spring, having a composition similar to that of Luhatschowitz, in Moravia, which is also a cold spring and found useful in chronic mucous inflamations and conjested liver and hœmorrhoids.

Analysis of Mineral Waters; Numbers 21 to 30.

No.	Salts Soluble in Water, Principally Alkaline Chlorides.	Salts Soluble in Acids, Principally Sulphate of Lime.	Silica.	Total Salts.	Loss by Ignition.	Reaction.
21	5·28	·74	7·86	13·88	3·47	faintly acid
22	13·88	4·31	9·25	27·44	3·08	,, ,,
23	3·85	1·69	2·94	8·48	1·54	,, ,,
24	138·07	4·21	10·03	152·31	3·09	,, ,,
25	64·72	1·63	18·51	84·86	12·97	,, ,,
26	8·13	9·24	15·75	33·12	1·52	slightly acid
27	24·12	3·84	28·51	56·47	3·24	,, ,,
28	127·62	9·62	6·25	143·49	4·61	neutral
29	6·16	3·08	12·33	21·57	4·65	slightly acid
30	3·09	4·62	6·10	13·81	3·08	,, ,,

The following is the composition, in grains per gallon, of numbers 31 and 32 (Tarawera and Parkes' Spring):—

——	No. 31.	No. 32.
Chlorine, with bromine traces ..	40·497	56·076
Iodine	·714	1·012
Sulphuric acid	2·150	2·156
Silica	2·221	16·752
Carbonic acid	traces	*35·751
Alumina	·621	—
Iron	1·049	—
Lime	2·036	1·994
Magnesia	·492	·613
Potash	3·681	5·675
Soda	46·495	80·710
Lithia	traces	traces
Phosphoric acid	—	—
	99·956	200·739

* The Carbonic acid in No. 32 is that which is in a combined form; there is, besides, a quantity of this acid in a free state.

33. Wangape, Waikato, is a hot alkaline water, having a composition similar to those of Puriri and Waiwera.

34. Onetapu Desert, at the sources of the Waikato and Wangaehu rivers. This powerful spring, which issues at the base of Ruapeha, is so strongly charged with sulphates of iron and alumina as to taint the water of the latter river from its source to the sea, a distance of seventy miles. It is only one of the many mineral springs which occur in the still active volcanic district of Tongariro.

35–38. In the East Cape and Poverty Bay district are four, out of some seventeen different springs which have been discovered, that yield hydro-carbons, either in the form of gas, or oil, and associated with saline waters. The source of these springs is probably certain bituminous shales at the base of the cutaceous formation.

39. Waipiro. Is interesting as being a hot spring in the same district but in which there is no evidence of any volcanic action, and from its depositing immense quantities of carbonate of lime in acicular crystals. This lime-deposit is built up in the form of a wall, marking the line of fissure through which the water escapes.

40–44. Are cold springs in the Wellington district, and belong to the class of saline waters, but are generally feebly acid. Springing from rocks of lower secondary formation they are interesting from the large proportion of iodine and other exceptional elements which they contain. Pahua is the most notable in this respect, and has the following composition :—

Chloride of sodium	1303·329
,, ,, potassium	·501
,, ,, magnesium	34·960
,, ,, calcium	120·885
Iodide of magnesium	·582
Bromide of magnesium	traces
Sulphate of lime	3·026
Phosphate of alumina	·641
,, ,, iron	traces
,, ,, lime	·430
Bi-carbonate of lime	6·451
Silica	1·696
Iodine, free	1·595
	1474·096

Total quantity of iodine to the gallon (free and combined), 2·127 grains.

42. Burton's Taipo, in addition to iodine, contains traces of arsenic.

43–44. Akateo (*a*), is a strong saline water containing iodides and bromides, while Akateo (*b*) is an ærated chalybeate water and would be valuable as a tonic, being similar to the springs at Pyrmont, Waldeck, and Recoaro, Venetia. Aerated Chalybeate waters of medicinal value are found in many other parts of New Zealand; among these may be mentioned a locality near Whangarei, in the north, and Chain Hills, near Dunedin, in the south.

45. The springs which occur at the Hanmer Plains, Amuri, are alkaline, with a strong escape of sulphurated hydrogen, and would form useful baths in rheumatic and cutaneous diseases.

46. At the distance of a few miles from Sumner Lake, water, having a temperature of 93° Fahr., gushes from the sandstone rock, but it does not contain sufficient matters in solution to entitle it to rank as a mineral water.

47. Amberley. This was analyised and reported on by Professor Bickerton, of the Canterbury College, as a chalybeate water, but unfit for use on account of the organic matter present. The analysis gave the following quantitative results ;—

	Grains per Gallon.
Total dissolved solids	37·6
Volatile	8·8
Fixed	28·8
Carbonate of lime	3·6
Carbonate of magnesia	2·2
Chlorine	10·5
Iron protoxide	2·3
Free ammonia	·069
Albuminoid ammonia	·034
Sediment	165·2

48. Wickliffe Bay, Otago. An analysis of this water is given by Professor Black, of Otago University. It appears to be a saline water :—

Analysis.	Grains per Gallon.
Sulphuric acid (combined)	39·3
Chlorine	112·0
Magnesia	18·3
Lime	11·5
Alkalis	83·0
Carbonic acid (combined)	12·6

49. Gibson's Spring, Southland, is a water which is stated to be a specific in diarrhœa, and contains a large amount of organic matter, to some astringent quality of which its medicinal qualities are probably due.

STATISTICAL DIAGRAMS.

With the view of presenting a ready means for comparing the economic progress of New Zealand and the Australian Colonies, some of the leading statistical features, common to all, have been collected and thrown into graphic form, a method of representation which has the double advantage of appealing to the understanding by means of an expression of form as well as of figures, and is especially applicable to purposes such as the present.

The period shown is that from 1868 to 1878, and the diagrams will afford opportunity for much interesting comparison, illustrative of the more or less rapid advances in material prosperity made by the Australasian group of colonies.

The diagrams treat of the following subjects :—

No. I.—POPULATION.

This shows the ratio of increase in the population of New Zealand and the Australian Colonies, England being also included for purposes of comparison. The great leap made by New Zealand in 1874 was due to the fact of the Immigration and Public Works Act having that year come into active operation, under the provisions of which an extraordinarily large number of immigrants were brought out by the Government. The somewhat low position shown in 1878 is accounted for by the circumstance of an error having accumulated in the estimated yearly returns of population between the census of 1874 and that of 1878, amounting to 9,004 persons; the correction being made in the return for 1878 necessarily lowers the apparent rate of increase for that year.

Next to New Zealand, Queensland shows the greatest fluctuations, the highest being in '74, '75, a sudden deep fall appearing next year, an abrupt rise in '77, and another drop in '78.

In New South Wales and South Australia the rate of increase is shown to have been pretty steadily improving the whole time, while in Victoria it has as steadily declined. Tasmania, except in 1878, occupies the lowest position, an actual decrease in the population of 0·5 being indicated in 1875.

The order of precedence in 1878, being the last year shown, stands thus :—South Australia (highest), New South Wales, Queensland, New Zealand, Tasmania, Victoria, and England (lowest.)

No. II.—MARRIAGES.

The marriage rate per thousand of population has fluctuated considerably in all the colonies, except Victoria, the rate there having steadily declined during the whole period The only colonies showing a higher rate, in 1878, than England, in 1875, are South Australia and New South Wales, New Zealand, Tasmania, and Queensland standing next in the order named, near one another, Victoria being much lower.

No. III.—BIRTHS.

The birth-rate exhibits a general decline in the whole group, with the exception of New Zealand and Tasmania. All the colonies show a higher rate than England, with the exception of Victoria and Tasmania, the rate in the latter colony continuing extraordinarily low, until 1878, which year shows a decided improvement. The almost continuous fall in the line representing Victoria is very remarkable.

No. IV.—DEATHS.

This diagram exhibits a curious uniformity in the general lines of fluctuation; the death-rate in the whole of the group being lowest in the year 1871, and highest in the year 1875. New Zealand occupies a remarkably good place in this diagram, her death-rate averaging about half that of England. Of the colonies, Queensland has the worst position, but in all, the death-rate contrasts very favourably with the rate of the home country: New South Wales, Tasmania, South Australia, and Victoria are placed very near to each other.

No. V.—IMPORTS AND EXPORTS. VI.—LOCAL EXPORTS.

In the first of these diagrams, South Australia and New South Wales occupy the highest position; and in the second, Queensland and South Australia. Neither Victoria nor New Zealand have maintained the positions they held at the commencement of the decade under notice, and Tasmania stands so low in both figures as to be seemingly quite out of the race.

No. VII.—SAVINGS.

In this diagram, which exhibits the rate of deposits in Post Office and other Savings Banks to population, all the colonies, it is shown, have made considerable progress. In South Australia and Queensland the advance has been remarkably great and rapid; Tasmania and New Zealand have, to a large extent, followed their good example, while New South Wales and Victoria appear to have somewhat lagged behind, the rate in the latter colony, in 1877, being less than the rate in England in the same year. For the sake of comparison, the average rate of Europe is also shown for the year 1877.

No. VIII.—RAILWAYS.

The proportion of constructed railways to population is shown in this diagram. The place of honour is occupied by New Zealand, and is marked 2·58 miles per 1,000 of population; Queensland, South Australia, Tasmania, Victoria, and New South Wales, following in the order named, all being better placed than the United Kingdom, the proportion in that country being 0·54 miles per thousand.

No. IX.—TELEGRAPHS.

The long Trans-Continental lines necessarily give prominent places in this diagram to Queensland and South Australia. New South Wales, New Zealand, and Tasmania, come next in order, very close together; then Victoria.

No. X.—CULTIVATION.

This diagram exhibits the area of land in cultivation (including land under sown grasses) in proportion to the population. The extraordinary progress made by New Zealand and South Australia in this direction is very strikingly shown. Tasmania occupies an almost unchanged medium position, and the colonies of Victoria, New South Wales, and Queensland have preserved, in near neighbourhood, a very low level, Victoria, however, showing a slight rise in the last three or four years.

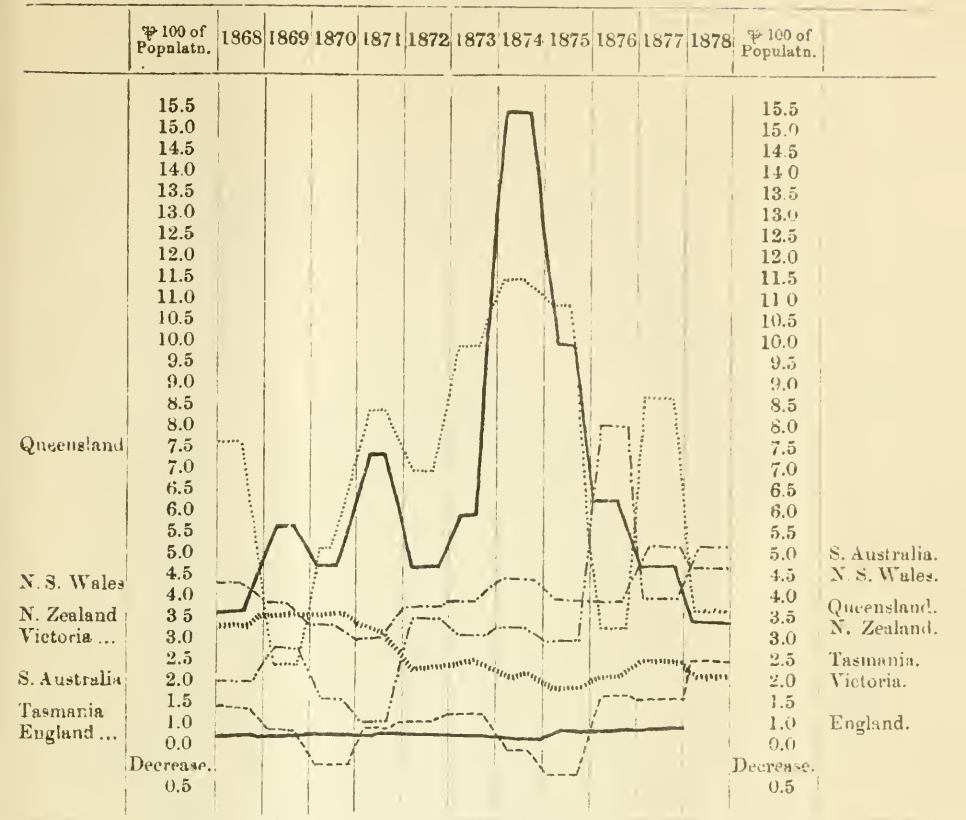
No. XI.—WHEAT.

The average yield of wheat per acre in the Australian colonies, shown in this diagram, contrasts favourably with the general average given of America. The yield in New Zealand stands considerably higher than that of the other colonies, Tasmania taking second place, New South Wales being next, then Queensland, Victoria, and South Australia, the average of the last-named colony being lower than that of America.

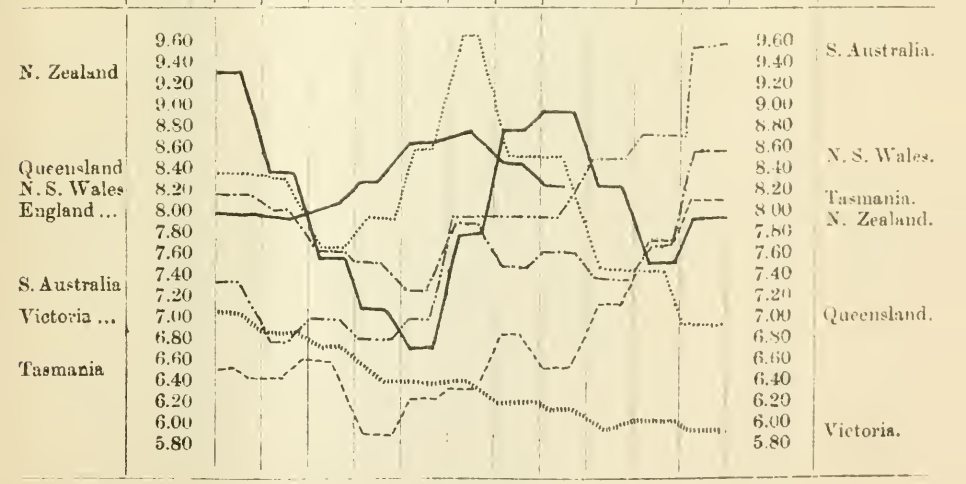
No. XII.—GOLD.

The value of gold raised in proportion to population during the years 1868-78, in the colonies of Victoria, New South Wales, Queensland, and New Zealand, is shown in this diagram so far as the information at command will permit. The decline in the quantity of gold raised in Victoria and New Zealand is very marked; the yield in New South Wales has fluctuated very little, and in Queensland the quantity of gold raised in 1874 was nearly double that of 1868, but it has since been falling off.

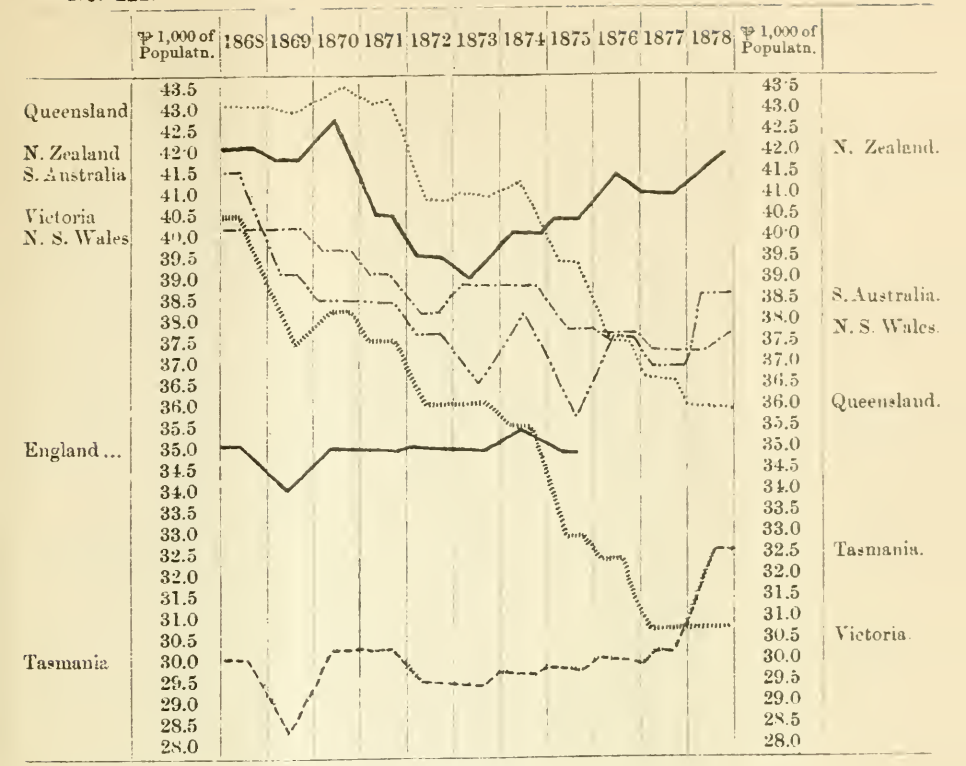
No. I. INCREASE OF POPULATION.



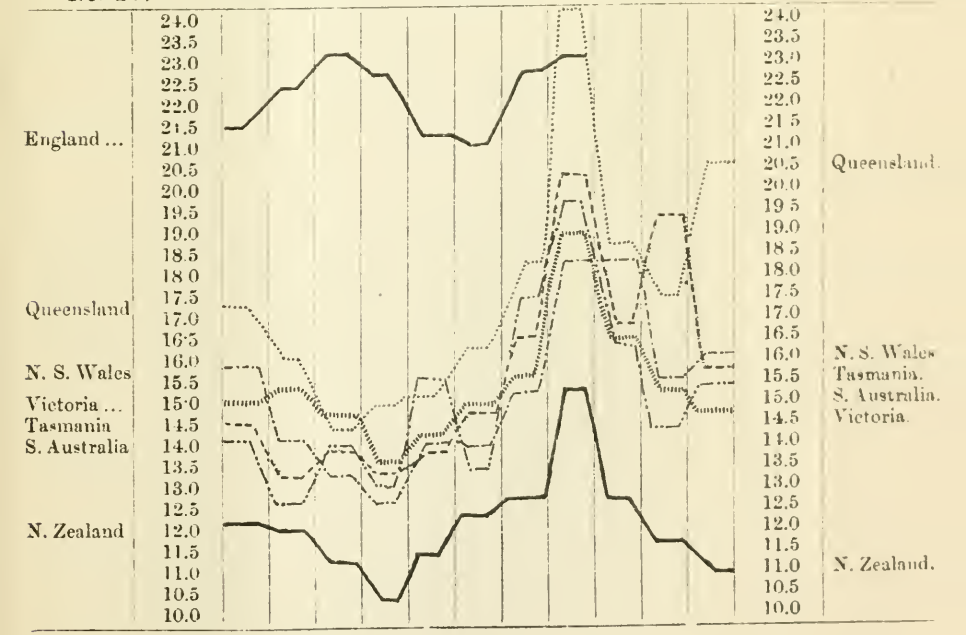
No. II. MARRIAGES.



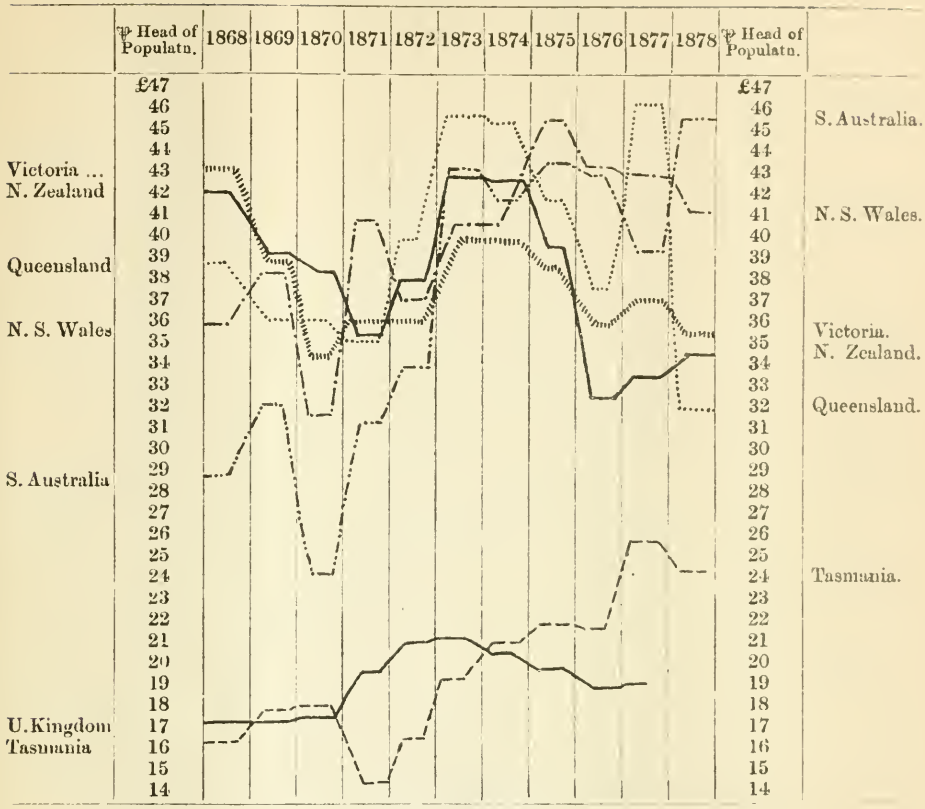
No. III. BIRTHS.



No. IV. DEATHS.

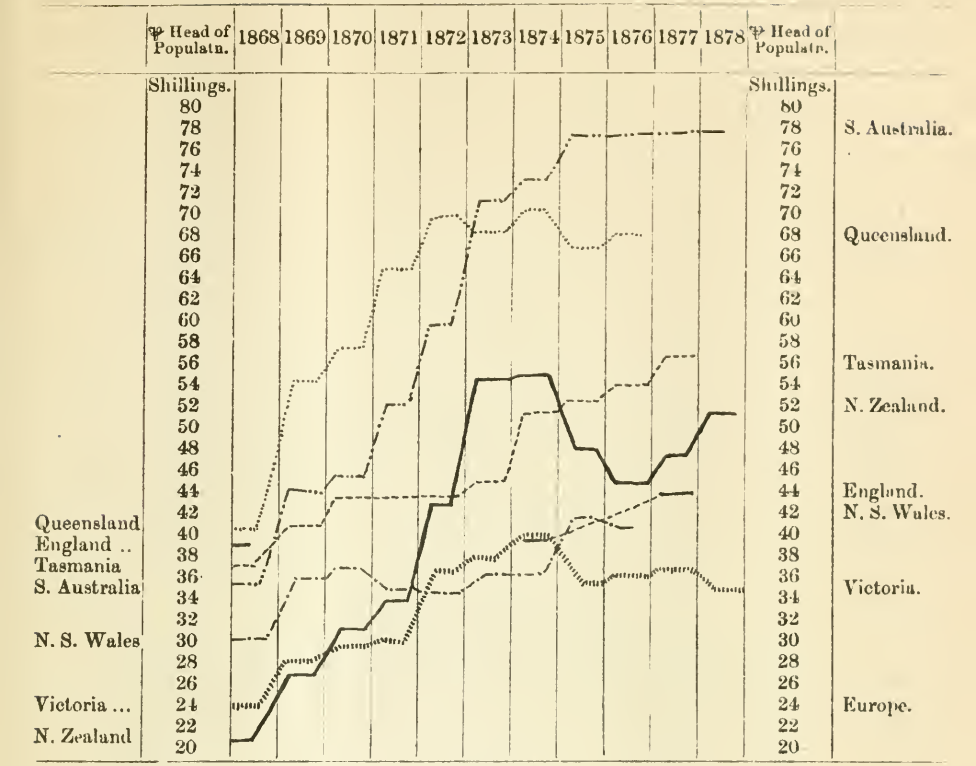


No. V. IMPORTS AND EXPORTS.

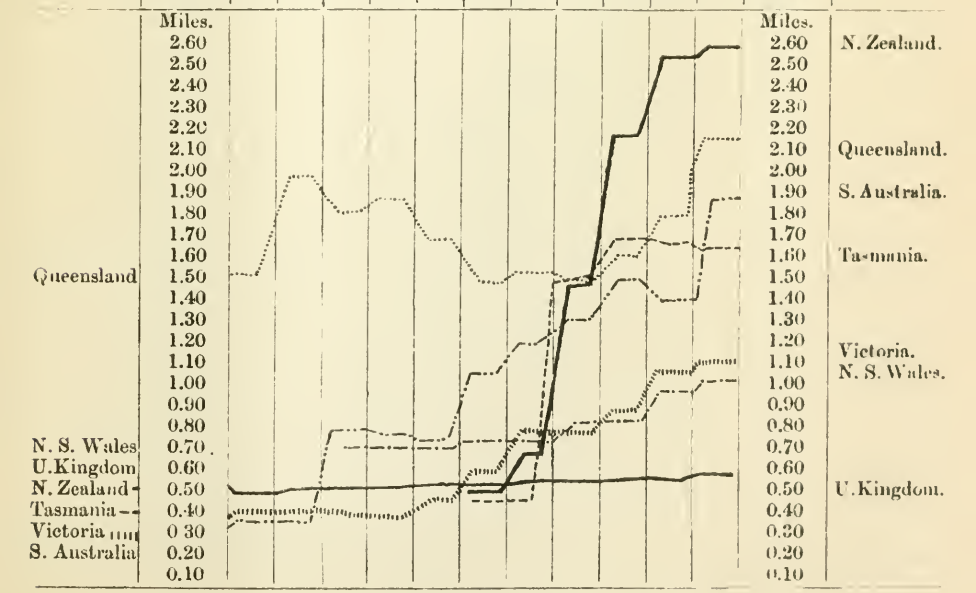


No. VI. LOCAL EXPORTS.

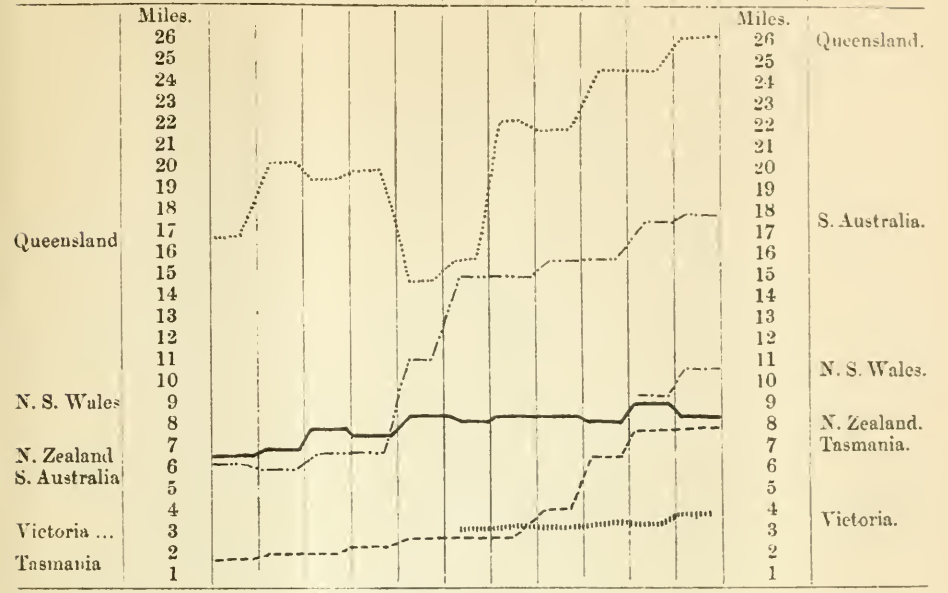
No. VII. DEPOSITS IN SAVINGS BANKS.



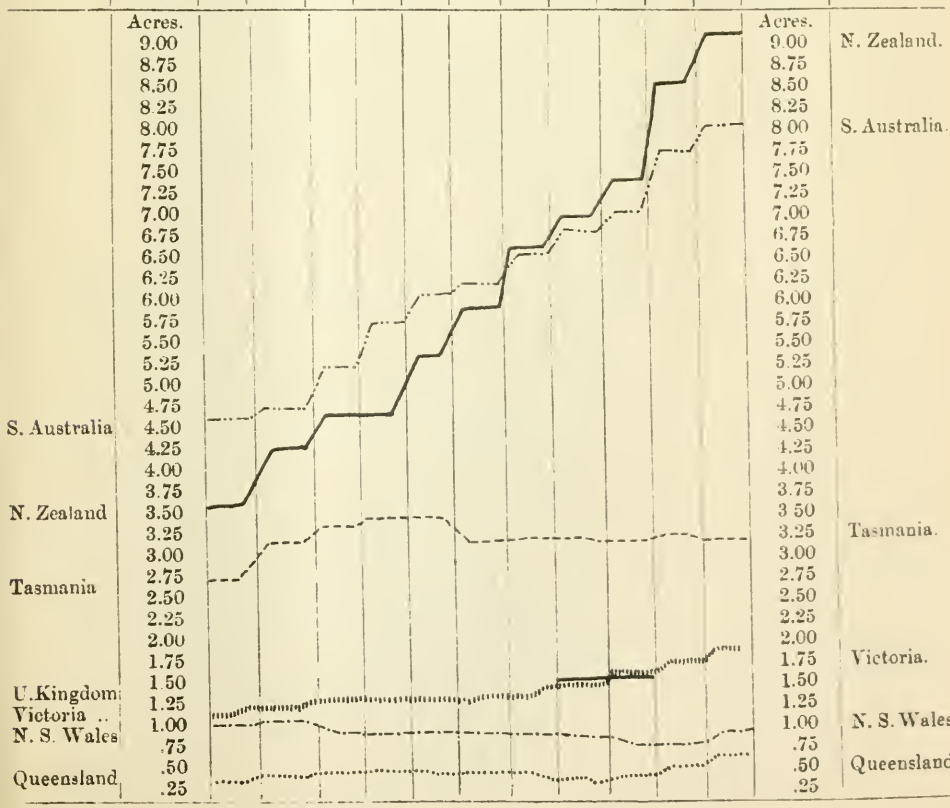
No. VIII. RAILWAYS.



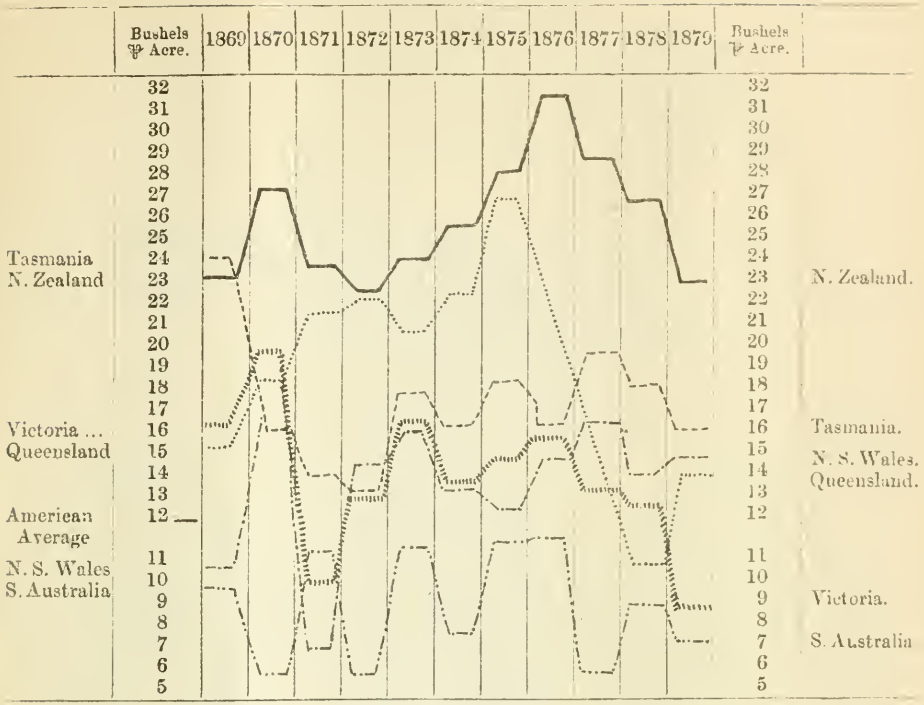
No. IX. TELEGRAPHS.



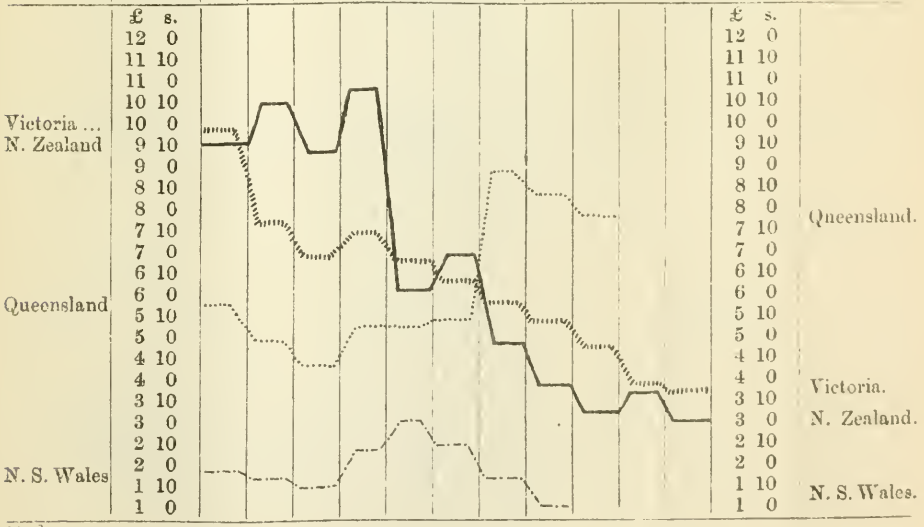
No. X. LAND IN CULTIVATION.



No. XI. AVERAGE YIELD OF WHEAT.



No. XII. GOLD RAISED.



AVERAGE WIND, TEMPERATURE & RAINFALL

— 1869 – 1878. —

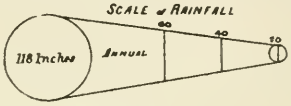
WIND —— *Represented by the small diagrams, the radii being drawn from the centre in the same direction as the wind.*

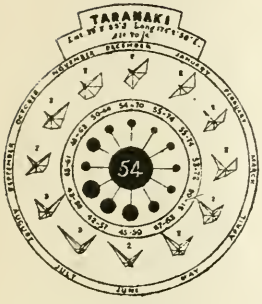
The Force is indicated by shades & figures

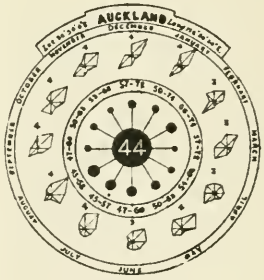
Under	*5000*	*miles per month*		1
5000	*to*	*7000*	. . .	2
7000	*to*	*9000*	. . .	3
Over	*9000*		. . .	4

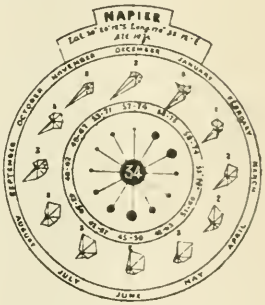
TEMPERATURE *The average mean minimum & mean maximum is shewn for each month thus 53·6 68·4*

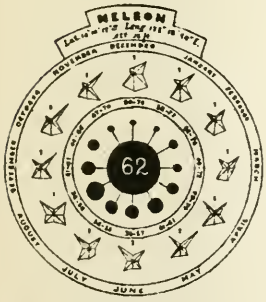
RAINFALL —— *The Black Spots are proportional to the amount of rain, the large central spot representing the total average yearly rainfall.*

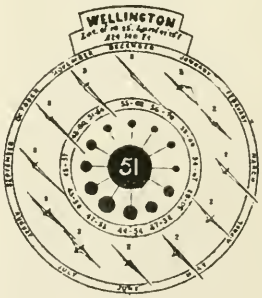


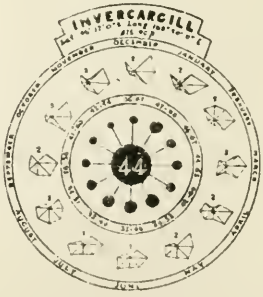


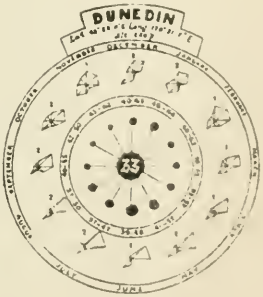













SKETCH MAP
OF
NEW ZEALAND
Showing
GEOLOGICAL FORMATIONS
REFERENCE
1 Post Tertiary (Recent) Pliocene.
2 Upper Miocene. Lower Miocene Upper Eocene
3 Cretaceo-tertiary
4 Lower Greensand & Coal area.
5 Jurassic. Liassic. Rhætic & Trias. Permian.
6 Lower Carboniferous Upper Devonian Lower Devonian Upper Silurian Lower Silurian
7 Foliated Schists.
8 Granite Crystalline rocks
9 Basic Volcanic rocks
10 Acidic Volcanic rocks
NORTH ISLAND
SOUTH ISLAND
STEWART I.
Bay of Islands
Hokianga
Kaipara H.
Manukau H.
New Plymouth
Napier
Poverty Bay
Gisborne
Wellington
Blenheim
Westport
Hokitika
Christchurch
Akaroa
Timaru
Oamaru
Dunedin
Invercargill
Jackson Bay
Martin Bay
Milford Sound
The Bluff


NEW ZEALAND
REFERENCE
STATISTICS
1875
BAY OF PLENTY
HAWKE BAY
NAPIER
AUCKLAND
WELLINGTON
NELSON
CANTERBURY
OTAGO
SOUTHLAND